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CRUISE REPORT

VESSEL: CRUISE *Oscar Elton Sette*, Cruise 04-01 (OES-10) (Fig. 1)

PERIOD: 8-29 January 2004

AREA OF OPERATION: Johnston Atoll; Howland and Baker Islands (U.S. Phoenix Islands)

TYPE OF OPERATION: Personnel from the Coral Reef Ecosystem Division, Pacific Island Fisheries Science Center, National Marine Fisheries Service (NMFS), NOAA, conducted reef assessment/monitoring and mapping studies in waters surrounding Johnston Atoll and the U.S. Phoenix Islands.

ITINERARY:

8-11 January Start of cruise. Embarked Ed DeMartini (fish), Alan Friedlander (fish), Jason Philibotte (fish), Greta Aeby (coral), Jim Maragos (coral), Scott Godwin (invertebrates), Peter Vroom (algae), Kim Page (algae), Joe Laughlin (towboard/fish), Brian Zgliczynski (towboard/fish), Molly Timmers (towboard/habitat), Jake Asher (towboard/habitat), Jamie Gove (moorings/tow), Kyle Hogrefe (moorings/tow), Jeremey Jones (moorings/tow), Christina Kistner (moorings/tow), John Rooney (QTC/TOAD/CTD), Beth Flint (Terrestrial), Chris Eggleston (Terrestrial) and June Firing (data management). Depart Snug Harbor at 0800 to transfer to fuel pier for fueling. Depart Honolulu at 1500 en route to Johnston Atoll to commence cruise. Terrestrial team conducted pelagic birding surveys during daylight hours.

12 January Arrived at Johnston Atoll. Completed 6 tows: 2 on the SW forereef, 1 on the SW insular reef, and 3 on the S insular reef. Conducted 2 fish and benthic REA surveys in lagoonal areas north of Johnston Island. Deployed WTR and 2 STR buoys. Scouted location for SST. Completed 4 deepwater CTDs at corners of the atoll and 4 ADCP transects.

13 January Continued work at Johnston Atoll. Completed 6 tows: 1 on the E insular reef, 1 on the SE insular reef, 1 on the S insular reef, and 3 in the N back reef/lagoon. Conducted 3 fish and benthic REA surveys in lagoonal areas northeast of Johnston Island. Deployed 2 STRs and completed 34 shallow

water CTDs. Completed 4 deep water CTDs at corners of the atoll and 4 ADCP transects.

14 January	Continued work at Johnston Atoll. Completed 5 tows: 2 on the NW forereef, 1 on the W forereef, 1 N of Johnston Island, and 1 in the back reef/lagoon N of Johnston Island. Conducted 3 fish and benthic REA surveys southeast of Johnston Island. Deployed SST. Conducted TOAD ops, followed by a deepwater CTD and ADCP.
15 January	Continued work at Johnston Atoll. Completed 6 tows: 2 on the central E insular reef, 1 on the central insular reef, and 3 on the NW back reef/lagoon. Conducted 1 fish and 2 benthic REA surveys around Johnston Island. Mooring team divers practiced towing techniques. Conducted TOAD ops, followed by a deepwater CTD and ADCP.
16 January	Continued work at Johnston Atoll. Completed 4 tows: 1 on the SE insular reef, 1 on the S insular reef, 1 on the W forereef, and 1 on the S side of Johnston Island. Conducted 2 fish and benthic REA surveys around Johnston Island. Mooring team divers practiced towing techniques. Conducted TOAD ops.
17-20 January	Departed for Howland Island, U.S. Phoenix Islands. Terrestrial team conducted pelagic birding surveys during daylight hours.
21 January	Arrived at Howland Island. Completed 6 tows encircling Howland Island. Conducted 3 fish and benthic REA surveys at existing permanent transects along the west side of the island. Deployed SST and 3 STR buoys. Completed 16 shallow water CTDs. Completed 2 deep water CTDs, 4 ADCP transects, and 4 TOAD transects.
22 January	Continued work at Howland Island. Completed 3 tows on the north and south sides of Howland Island. Conducted 2 fish and coral REAs, and 1 algae REA. Benthic teams completed a 90-ft dive, and fish team collected fish for DNA analysis. Deployed 1 STR and 8 shallow water CTDs. Retrieved old SST buoy (deployed 2002) from beach. Completed 2 TOAD transects and 1 deepwater CTD. Transited to Baker Island and began ADCP transects.
23 January	Arrived at Baker Island. Completed 6 tows almost encircling Baker Island. Conducted 3 fish and benthic REA surveys at existing sites along the east and south shores. Retrieved and replaced ODP, deployed 1 STR, and conducted shallow water CTDs. Completed 2 deepwater CTDs and 1 TOAD transect. TOAD was snagged and lost.
24 January	Continued work at Baker Island. Completed 2 tows on Baker Island. Conducted 3 fish and benthic REA surveys at existing sites along the west shore. Deployed 3 STR buoys, and conducted shallow water CTDs. Completed 6 deep water CTDs and ADCP lines.

25-29 January — Departed for Tutuila, American Samoa. Terrestrial team conducted pelagic birding surveys during daylight hours.

CRUISE STATISTICS:

	Johnston Atoll	Howland Island	Baker Island
Towed Diver Habitat/Fish Surveys	27	9	8
Fish Rapid Ecological Assessments	12	5	6
Benthic Rapid Ecological Assessments	12	4	6
Wave and Tide Recorders (WTR) Deployed	1	0	0
Ocean Data Platforms (ODP) Retrieved and Replaced	0	0	1
SST buoys deployed	1	1	0
SST buoys retrieved	0	1	0
STR buoys deployed	4	4	4
SVP drifters deployed	1	0	0
TOAD drop camera surveys	9	6	1
Deepwater CTDs	10	4	8
Shallow water CTDs	34	24	35
SCUBA dives	177	81	81

Table 1: Cruise statistics for Johnston Atoll and the U.S. Phoenix Islands.

MISSIONS AND RESULTS:

A. Used established quantitative methods to estimate fish stock biomass and fish species richness, respectively, at representative stations to contribute to an initial baseline assessment (at Johnston Atoll) or initiate monitoring for temporal changes (Howland, Baker Islands). See Appendix A.

1. Totals of 12, 5, and 6 stations were (re)surveyed for fishes by the 3-diver Fish REA Team at Johnston Atoll and at Howland and Baker Islands, respectively. The most striking aspect of observations at Johnston were (1) the low (relative to the Hawaiian Archipelago) fish species diversity and (2) the relative scarcity of small juvenile (recent recruit) individuals. Both features probably reflect the extreme isolation of Johnston Island from other shallow-water reef habitats.

   At Howland and Baker Islands, resurveying of select historical stations confirmed the continued presence of species-rich (over 200 species overall), high-standing biomass fish assemblages dominated by carangid (jack) and shark apex predators and extremely abundant moderate- to large-bodied benthic carnivores, primarily groupers and snappers. Fish assemblages continued to be overwhelmed numerically by large swarms of small-bodied plankton feeders (primarily anthiine basslets) concentrated at current-upwelled reef faces along the leeward sides of the islands.

B. Conducted surveys to document the species composition, abundance, percent cover, size distribution, and general health of the shallow water corals at Johnston Atoll and the U.S. Phoenix Islands.

1. Full REA surveys were conducted at 12 sites around Johnston Atoll. Mild bleaching of relatively few colonies was found at 8 out of 12 sites. Corals with signs of potential disease were observed at 11 of 12 sites. Incidence and abundance of potential coral disease appeared higher than has been observed in the NWHI. Types of syndromes/diseases include: plaque-like signs on *Acropora cytherea,* patchy necrosis (tissue loss) on *M. patula, M. capitata* and *M. incrassata*, ring syndrome was observed on *M. patula* and *M. capitata*, protuberant tumors were found on *M. patula* and abnormal growths were found on *M. patula*. There was very little predation (fish, snail, COT) found on corals.

Eleven surveys were conducted in the Phoenix Line Islands: six at Baker Island and five at Howland Island. Reefs in both areas were in good condition with only mild bleaching observed and very few colonies with any signs of disease.

C. Used quantitative photoquadrat sampling method to collect species composition and baseline abundance data of reef algae at Johnston Atoll and the U.S. Phoenix Islands to compare with previously collected qualitative samples (Appendix C).

1. A total of 264 algal photoquadrats (with accompanying field-ranked species lists and voucher specimens) were sampled at 22 sites: 12 at Johnston Atoll, 6 at Howland Island, and 4 at Baker Island (Appendix C). Although turf algae and crustose coralline algal pavements were pervasive, macroalgal cover was low at all islands with most large species found in relatively protected areas between coral fingers. Six genera of green, 8 genera of red, and 2 genera of brown macroalgae were observed at the 3 islands. Red algal floras differed substantially between Johnston Atoll and the Phoenix Islands, with no red algal genera shared between the 2 geographic areas. However, green and brown algal floras were similar, with 6 of the 8 genera discovered being found at all islands sampled. Although not as diverse as red algal genera, green algal genera (particularly species of *Halimeda*) composed the bulk of macroalgal biomass seen.

D. The non-coral marine invertebrate fauna of coral reefs represents a group of animals that are numerically dominant in their habitat and in some cases represent taxonomic groups that are only represented in the marine environment. This group of organisms is surveyed and monitored for the purpose of identifying changes to reef communities. This is accomplished through procedures that quantify a set of target organisms and which also gradually builds an inventory of species to document biodiversity. See Appendix D.

1. A total of 24 sites were surveyed; 12 at Johnston Atoll, 6 at Howland Island, and 6 at Baker Island. Specifically the total sampling units were as follows: 24 transects and 24 10X25 meter quadrats for Johnston Atoll, 12 transects and 12 10X25 meter quadrats for Howland Island, and 12 transects and 12 10X25 meter quadrats for Baker Island. Species data is preliminary at this point and involves non-coral species quantified from field observations, which

represented 6 phyla. The phylum Cnidaria was represented by 5 species from the class Hydrozoa and 5 species from the class Anthozoa. Only a single species from the phylum Annelida was enumerated from the field observations, but many more species remain to be identified from field collections. A total of 181 species from the phylum Mollusca were identified and are composed of 135 species from the class Gastopoda and 46 species from the class Bivalvia. None of the species from the subphylum Crustacea are enumerated to date but they are represented by the orders Decapoda, Amphipoda, Tanaidacea, Isopoda, and Stomatopoda. A total of 17 species were enumerated from the phylum Echinodermata, which included 3 species from the class Asteroidea, 7 species from the class Echinoidea, 5 species from the class Holothuroidea and 2 species from the class Ophiuroidea. The subphylum Urochordata was represented by two species, both from the order Aplousobranchia. Continued efforts with specimens collected from the field will reveal additional phyla but will also increase the species compliment for the taxonomic groups already identified. The bulk of species were represented by the phyla Mollusca and Echinodermata.

E. Used benthic and fish towed-diver survey methods at Johnston Atoll and the U.S. Phoenix Islands to provide a general description of reef habitat, invertebrates, and reef fishes over a large spatial scale. The methods provided assessments and the foundation for monitoring large-scale disturbances and general distribution and abundance patterns of macroinvertebrates and reef fishes over 50 cm total length (Appendix E).

1. A total of 44 towed-diver surveys were conducted totaling approximately 91 km of habitat: 53 km from 27 tows at Johnston Atoll, 21 km from 9 tows at Howland Island, and 17 km from 8 tows at Baker Island. An initial baseline assessment of reef fish assemblages was conducted at Johnston Atoll with the most common fish (larger than 50 cm TL) observed being gray reef sharks (*Carcharhinus amblyrhynchos n=101*). Preliminary results from the surveys conducted at Howland and Baker Island yielded the twin spot snapper (*Lutjanus bohar*) as the most abundant fish (larger than 50 cm TL) with 870 observations made during the survey period.

   Coral appearing pale to the benthic observer was low at all three locals; Johnston having the highest percentage at 1.16%. Coral habitat appearing white was only observed at Johnston Atoll with .23%. The benthic observer did not record any crown-of-thorns starfish (COTS), *Acanthaster planci*, at Howland or Baker. One hundred and eighty two COTS were observed at Johnston Atoll.

F. Conducted near and off-shore oceanographic surveys and deployed a variety of surface and subsurface oceanographic instruments at Johnston Atoll and the U.S. Phoenix Islands with the goal to quantify, assess, and gain a better understanding of the overall hydrographic environment near these islands. See Appendix F.

1. A total of 44 shallow and deep water conductivity, temperature and depth (CTD) casts were performed at Johnston Atoll. Preliminary results show a well mixed upper 50-100 meters on the perimeter with lagoonal casts showing increased stratification. These conditions are likely due to the presence of a large swell

event during field operations resulting in deep mixing of the external reef while having little influence on the internal lagoon, which tends to be dominated by diurnal heating and cooling from solar radiation. A telemetered sea surface temperature buoy, 4 subsurface temperature recorders, and 1 wave recorder were also deployed at Johnston.

Howland and Baker Islands are of oceanographic interest as they are geographically located in the middle of two major ocean currents, the Equatorial Undercurrent (EUC), and the South Equatorial Current (SEC). Due to this unique current regime, differences greater than 1 degree Celsius temperature has been measured from one side of the islands to the other. Preliminary results from deep and shallow water CTDs taken this year however do not show this trend. Temperatures were nearly homogenous surrounding both islands, with the exception of Baker which had 0.2 to 0.3 degree differences on the western side compared to surrounding waters. This trend is likely due to the occurrence of an extremely deep thermocline centered near 190 meters during field operations at both islands. In addition, a total of two telemetered sea surface temperature buoys, 1 ocean data platform and 8 subsurface temperature recorders were deployed.

G. Goals for night operations during OES0401 included deployments of the Towed Optical Assessment Device (TOAD) to videotape portions of the seafloor, as well as the collection of QTC (benthic acoustic signature) data, acoustic doppler current profiler (ADCP) transects, and conductivity, temperature and depth (CTD) casts (Appendix G).

1. The TOAD was deployed a total of 21 times during OES0401, and it successfully videotaped the seafloor for durations of approximately 15 minutes to over an hour each time. On both Howland and Baker Islands we observed deeper habitats, in the approximate depth range of 80-100 m, with complex vertical structure and surprisingly large concentrations of reef fish, sharks, rays, etc. that were more similar to what we would expect during daylight hours. Of particular interest, several Tinker's butterfly fish, *Chaetodon tinkeri* were observed over multiple tows. This species has never been recorded at these islands before, and these sightings represent a significant increase in the geographic range of these fish, previously reported only in the Hawaiian, Marshall, and Cook Islands. A total of 19 CTD casts were made despite problems of frozen bearing on the idler sprocket on the CTD winch which precluded operations for a time. Heading problems were encountered with the ADCP so it is unclear at this time how much of the 437 km of ADCP transect data collected during OES0401 will be recoverable.

H. The terrestrial team conducted pelagic bird and mammal transects during transit between islands. On shore, a standard rapid ecological assessment of the islands were made by counting and staging all active nests of breeding seabirds, counting wintering shorebirds, listing all plant species and recording their phenological condition, as well as looking for other biological phenomena and signs of trespass or introductions of non-native invasives. Appendix H.

SCIENTIFIC PERSONNEL:

Peter Vroom, PhD, Chief Scientist, Benthic Team – Algae, UH-JIMAR, PIFSC-CRED
Kimberly Page, Benthic Team – Algae, UH-JIMAR, PIFSC-CRED
Scott Godwin, Benthic Team – Invertebrates, Bishop Museum
James Maragos, PhD, Benthic Team – Corals, USFWS
Greta Aeby, PhD, Benthic Team – Corals, Hawaii DLNR-DAR
Edward DeMartini, PhD, Fish Team, NOAA-NMFS
Alan Friedlander, PhD, Fish Team, NOS, Oceanic Institute
Jason Philibotte, Fish Team, Boston University
Brian Zgliczynski, Towboard Team – Fish, NOAA-NMFS
Molly Timmers, Towboard Team – Habitat, UH-JIMAR, PIFSC-CRED
Joseph Laughlin, Towboard Team – Fish, UH-JIMAR, PIFSC-CRED
Jacob Asher, Towboard Team – Habitat, UH-JIMAR, PIFSC-CRED
Jamison Gove, Mooring Team, UH-JIMAR, PIFSC-CRED
Kyle Hogrefe, Mooring Team, UH-JIMAR, PIFSC-CRED
Christina Kistner, Mooring Team, UH-JIMAR, PIFSC-CRED
Jeremey Jones, Mooring Team, UH-JIMAR, PIFSC-CRED
John Rooney, PhD, Habitat Mapping Team – Towed Camera, UH-JIMAR, PIFSC-CRED
Elizabeth Flint, PhD, Terrestrial Team, USFWS
Chris Eggleston, Terrestrial Team, USFWS
June Firing, Data Manager, UH-JIMAR, PIFSC-CRED
Phil White, Senior Survey Tech, NOAA ship *Oscar Elton Sette*

DATA COLLECTED:

Digital images of diseased coral
Field notes on signs of coral bleaching or disease
Samples of diseased coral for histopathological analysis
Digital images from algal photoquadrats
Algal voucher specimens
Algal field notes of species diversity and relative abundance
Acoustic Doppler Current Profile (ADCP) data
Digital images of the benthic habitat from towboard surveys
Macro-Invertebrate counts from towboard surveys
Quantitative surveys of reef fishes (larger than 50 cm TL) to species level from towboards
Habitat lineation from towboard surveys
Benthic composition estimations from towboard surveys
Videos of the seafloor from TOAD operations
QTC (benthic acoustic signature) data
Acoustic doppler current profiler (ADCP) transects
Conductivity, temperature and depth (CTD) profiles to 500 m

Submitted by: ____
Peter S. Vroom, Ph.D.
Chief Scientist

Approved by: ____
Samuel G. Pooley, Ph.D.
Science Director, Pacific Islands Fisheries
Science Center

Attachments

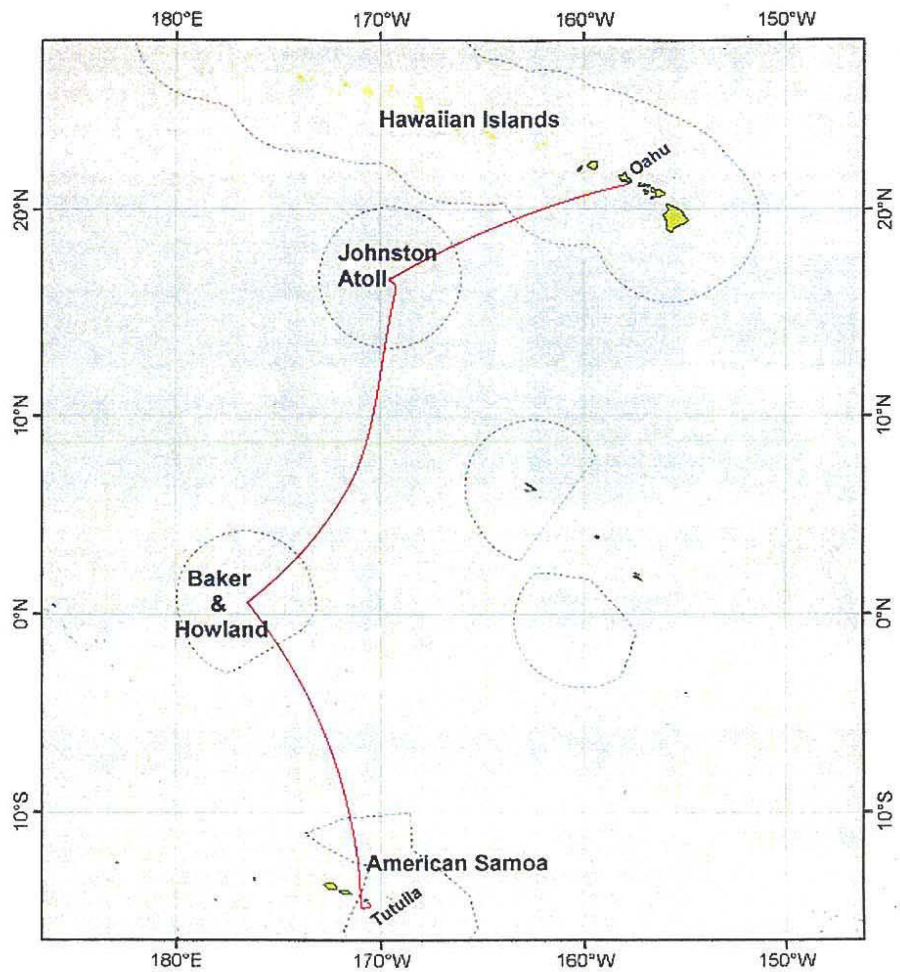

Figure 1.--Track of the Oscar Elton Sette OES-04-01 (OES-10), January 8-29, 2004.

Appendix A: **Fish REA Team Activity Summary** *(Ed DeMartini, Alan Friedlander, and Jason Philibotte)*

A. Methods

Fish survey methods followed the same protocols that have been used during the period from 2000 to the present in the NWHI; at the PRIAs (Howland, Baker, and Jarvis Islands; Palmyra and Kingman Atolls), at American Samoa, Swains Reef, and Rose Atoll; and in Guam and the CNMI. At each station, 2 of the 3 divers surveyed all of the non-cryptic fishes (day-active, > 2-cm Total Length, TL) observable within 3, 25-m long belt (strip) transects totaling 600 m^2 area. The 3rd diver simultaneously conducted 4, 5-min Stationary Point Counts (SPCs) totaling about 1250 m^2 for larger-bodied fishes > 25 cm TL. Divers rotated between belt transect and SPC tasks on successive dives in order to distribute unavoidable biases among tasks. The quantitative tallies were complemented by "roving diver swims" throughout the general station area (2000-3000 m^2, depending on underwater visibility). All observations were used to generate station-specific species lists. Due to a large northwest storm swell, all Fish REA Surveys were restricted within the atoll (11 were conducted in the lagoon and one on the backreef). A 13th, 75-min dive was used to collect specimens (n=17) of domino damselfish (*Dascyllus albisella*) for genetic studies.

B. Results

1. Johnston Atoll

The 3-member team of Ed DeMartini (NOAA Fisheries, PIFSC, Honolulu), Alan Friedlander (NOAA, NOS, and Oceanic Institute, Oahu), and Jason Philibotte (Boston University, Mar Biol Lab) completed a total of 12, approximately 1-hr dives at 12 stations during the 5-day period.

Fish REA observations suggested several interesting patterns of reef fish diversity and abundance that contrast markedly with those in the Hawaiian Archipelago, especially the NWHI. Reef fish diversity was low; many abundant Hawaiian, including endemic, species were either absent or rare, and several widely distributed Indo-Pacific species (abundant in Hawaii) were conspicuously absent (bigeye emperor, *Monotaxis grandoculis*; bluespine unicornfish, *Naso unicornis*). Overall numerical densities of reef resident species appeared low, perhaps ¼ to 1/3 less than those in the NWHI, at least partly so because of the general scarcity of juvenile fishes. Standing biomass also appeared relatively low, with this mostly due to few large-bodied species. Carangids like the bluefin trevally (*Caranx melampygus*) were infrequently observed and often small in size; no giant trevally (*C. ignobilis*) were encountered. Grey reef sharks (*Carcharhinus amblyrhynchos*) appeared to be in robust body condition but uncommonly observed. Reef sharks are known to be locally abundant, except for sites like the "Garbage Chute" that were purposely not dived. The observed scarcity of both carangids and reef sharks likely in part reflects the unavoidable survey emphasis on lagoon stations. It is very possible that the dearth of juvenile life-stages is a reflection of the infrequent, low-intensity recruitments that occur at a very isolated atoll inhabited by substantively self-seeding reef fish populations. Disproportionately large numbers of terminal phase males in many species of protogynous (female-to-male sex-changing) labroids (e.g., bird wrasse, *Gomphosus varius*; *Thalassoma duperrey*, *T. lutescens*, and *T. quinquevittatum*; and bullethead and spectacled parrotfish, *Chlorurus sordidus*, and *C. perspicillatus*, respectively) suggest that social control of the ontogeny of sex change might be affected by the low rate of juvenile-initial phase (female) replenishment. At least one conspicuously developed case of hybridization involving three species in the labrid genus *Thalassoma* (*lutescens*, *quinquevittatum*, and the Hawaiian-Johnston endemic *duperrey*) suggests that behavioral isolating mechanisms also might be weakened under conditions that promote inbreeding.

Conclusions are limited, however, because of the near or total lack of data for backreef and forereef habitats, respectively. Data for these habitats and appropriate statistical analyses are necessary before any firm conclusions regarding Johnston-Hawaii patterns of reef fish distribution and abundance can be made.

2. U.S. Phoenix Islands

The 3-member team of Ed DeMartini (NOAA Fisheries, PIFSC, Honolulu), Alan Friedlander (NOAA, NOS, and Oceanic Institute, Oahu), and Jason Philibotte (Boston University, Mar Biol Lab) completed a total of 12, approximately 1.5-hr dives at 12 stations during the 4-day period.

Six dives (five REA plus fish collection, 1 entirely fish collection) were completed at Howland and six (all REA plus fish collection) were completed at Baker Island. REA portions of the dives lasted about 75 min; the time remaining on most dives was used to collect fish specimens for genetics studies and taxonomic vouchers. Fish survey methods followed the same protocols that have been used since the year 2000 NOWRAMP (NWHI) expeditions, including the just-completed (January 11-16) OES04-01 surveys at Johnston Atoll. At each station, 2 of the 3 divers surveyed all of the non-cryptic fishes (day-active, > 2-cm Total Length, TL) observable within 3, 25-m long belt (strip) transects totaling 600 m^2 area. The 3rd diver simultaneously conducted 4, 5-min Stationary Point Counts (SPCs) totaling about 1250 m^2 for larger-bodied fishes > 25 cm TL. Divers rotated between belt transect and SPC tasks on successive dives in order to distribute unavoidable biases among tasks. The quantitative tallies were complemented by "roving diver swims" throughout the general station area (2000-4000 m^2, depending on underwater visibility, which was generally limited to 40-60 ft.). All observations were used to generate station-specific species lists. Due to a large northwest storm swell, surveys at Howland were restricted to the leeward (W-SW to W-NW) side of the island; at Baker (where island configuration afforded better protection from the northwest swell), surveys were conducted at one station each on the E, SE, and mid-S sides, plus 3 stations on the W-SW to W-NW leeward side of the island. Thus, five monitoring stations were established at W Howland and six monitoring stations, spanning three of the four sides of the island, were established at Baker.

Totals of about 30 and 60 fish specimens were collected at Howland and Baker, respectively. About one-half of all specimens were arc-eye hawkfish *Paracirrhites arcatus* (23% of total) and gold-finned domino damselfish *Dascyllus auripinnis* (24%); another 46 individuals of six species comprised the remainder. The latter included two voucher specimens of an unusual color morph (typee but uniformly grey body with red anterior head and trunk dorsum) of the blackside hawkfish *Paracirrhites forsteri*, seen only at W and W-NW Baker stations 5 and 11. A single specimen of the questionable wrasse species *Bodianus prognathus/diana*, common at most W Howland stations, was collected and keyed out aboard ship as *B. diana*. *Bodianus prognathus* was provisionally recorded as present in low numbers only at Howland.

Reef Fish REA observations documented totals of 164 and 166 fish species at Howland and Baker, respectively, and about 200 species at both reefs pooled. Species richness averaged 118 and 117 species (median among stations) at the respective reefs. Some additional species (humphead wrasse *Cheilinus undulatus*—see below, the lionfishes *Pterois antennata and P. volitans*, leaf scorpionfish *Taenianotus triacanthus*, multi-barred *Centropyge multifasciatus* and bicolor *C. bicolor* angelfishes, and black snapper *Macolor niger*) were seen only by other REA and Towboard Fish Team divers for a grand total of about 210 fish species. Some observations (e.g., *C. multifasciatus*, noted by the Towboard Fish Team on the north reef slope off both Howland and Baker, and *P. volitans*, photographed by Jim Maragos at 90 ft. on the reef slope off Howland station 5, may represent new records for Howland-Baker. The longfin bannerfish *Heniochus acuminatus* was recorded on nighttime TOAD video at Howland (50 m). Tinker's butterflyfish, *Chaetodon tinkeri*, was also observed by TOAD video at night on the deep (50-80 m) reef slope at both reefs, previously reported only from the Hawaiian, Marshall, and Cook Islands; this represents a large geographic range extension for *Ch. tinkeri*.

Both numerical and biomass densities of resident reef fish species remained high (as observed on the year 2001 and 2002 surveys). A trophically diverse fish fauna, representative of healthy coral reef ecosystems, contributed to the high biomass. The body size distributions of fishes spanned a broad range of sizes, further indicative of a healthy fish assemblage. Foremost numerically were three species of small-bodied (< 10 cm TL) zooplanktivores (two species of anthiine basslets: *Pseudanthias bartlettorum* and *Luzonichthys whitleyi*, and the basslet-like damselfish *Lepidozygus tapeinosoma*—especially off leeward upwelled slopes and walls). Major contributors to biomass included numerous medium-sized (10-20 cm TL) benthic fishes (both herbivorous surgeonfishes and parrotfishes and benthivorous carnivores); and diverse, large-bodied (generally 25-60 cm TL) resident and transient piscivores. Among the latter (ordered by approximate decreasing biomass), red snapper (*Lutjanus bohar*), grey reef sharks (*Carcharhinus amblyrhynchos*), reef whitetip sharks (*Triaenodon obesus*), and several carangids (primarily the black jack *Caranx lugubris* and rainbow runner *Elegatis bipinnulatus*, but also including bluefin trevally (*C. melampygus*), dominated the piscivore biomass in midwaters near the reefs. No giant trevally (*C. ignobilis*) were encountered at Howland, however, and only several were seen on Fish REA surveys at Baker. Grey snapper ("uku", *Aprion virescens*) were conspicuously absent from Fish REAs at both reefs. A half dozen species of serranids (primarily the peacock grouper *Cephalopholis argus*, blacktip grouper *Epinephelus fasciatus*, coral hind *Cephalopholis miniata*, and flagtail grouper *C. urodeta*) also continue to contribute much to near-reef fish biomass, and the slenderspine grouper *Gracilla albomarginata* remains common in waters near and below the crests of both reefs. The density of groupers at both reefs appears substantially higher than at American Samoa, Rose Atoll, Swains Reef, Guam, and the CNMI, particularly at sites like main Samoa and Guam where substantial fishing occurs. Several large-bodied zooplantivorous acanthurids (*Naso vlamingii*, *Acanthurus mata*, *N. hexacanthus*, and *N. caesius*) also contributed much to off-slope biomass at both reefs. Bigeye emperor, *Monotaxis grandoculis*, were patchily common at both reefs. Bluespine unicornfish, (*Naso unicornis*) were rarely seen, and only at Baker. Humphead ("Napoleon") wrasse were not encountered on Fish REAs but were observed twice by the Towboard Fish Team—one and three large individuals were seen on the deep reef at

Howland and Baker, respectively. More specific breakdown of distribution and abundance patterns would require statistical analysis.

Appendix B: **Coral REA Team Activity Summary** *(Jim Maragos and Greta Aeby)*

A. Methods

The first two 25-m transect lines, previously laid out by the fish team, were videotaped. The videotapes will be used at a later time to analyze percent cover data and will provide a permanent record of the condition of the benthos. The two 25-m transect lines were surveyed for coral colonies by maximum diameter, genus, and health. All corals whose colony center fall within 0.5-1 meter on either side of the transect line were enumerated and assigned to one of 7 size classes: <5 cm, 6-10, 11-20, 21-40, 41-80, 81-160, and >160 cm. Transect data will be used to estimate population size classes, mean diameter, frequency/density, diversity, percent cover, and other quantitative coral parameters. In addition, surveys were conducted along and beyond the first 2 transect lines to document incidence of coral bleaching and/or disease and additional species of corals not occurring within transects. The relative abundance of all coral species and the overall percent coral cover were visually estimated over the broader area.

B. Results

1. Johnston Atoll

Full REA surveys were conducted at 12 sites (OES1-OES12) around Johnston Atoll by the benthic team between January 12, 2004 and January 16, 2004. Coral species inventories, colony counts and DACOR relative abundance were conducted by Dr. Jim Maragos, USFWS with coral bleaching, predation, and disease assessment being conducted by Dr. Greta Aeby, DAR. Candidate sites were chosen from a variety of habitats but were limited to lagoon sites by a large northwest swell that hit the atoll. Dive depths ranged from 12 to 56 feet. One permanent 50-m transect was established at site JOH-OES-10P and a brief snorkel survey of the backreef was also accomplished near the northern rim of the perimeter reef. The January 2004 surveys at Johnston concentrated in shallow lagoon habitats protected from a large northwest swell during the survey. As a consequence, forereef, backreef, southwest and northeast lagoon reefs, and reefs deeper than 60 ft. were not investigated.

*General observations of coral diversity, distribution and abundance***.** Earlier coral surveys at Johnston covered in Maragos and Jokiel (1986) reported 33 species and 16 genera of stony corals. Subsequent surveys have raised the stony coral species totals to 40, including one new record during the 2004 surveys (*Pocillopora molokensis*). Although no species endemic only to Johnston are reported in the literature, 6 of the stony coral species are considered endemic to a broader region including Hawai‘i and the Northern Line Islands. However, our 2004 observations suggest that several of the species show morphological differences from their closest relatives elsewhere, and genetic studies will likely be needed to determine the extent of endemism, if any, in Johnston corals. Johnston is among the most geographically isolated reefs in the Pacific which helps to explain the low levels of coral diversity at the atoll as well as the low species totals at individual REA sites. Also unusual is the observed dominance of *Acropora*, *Montipora, Pavona,* and *Millepora* in lagoon and forereef habitats at Johnston which differs substantially from the *Porites-, Pocillopora-,* and *Montipora*-dominated habitats in Hawai‘i. Again, geographic isolation and reliance on self recruitment may be factors leading to these disparities at Johnston.

General observations on bleaching and disease. Mild bleaching of relatively few colonies was found at 8 out of 12 sites. Mild bleaching was observed on *Montipora patula, M. capitata* and *Acropora cytherea*. Corals with signs of potential disease were observed at 11 of 12 sites. Incidence and abundance of potential coral disease was much higher than was observed in the NWHI. Types of syndromes/diseases include plaque-like signs on *Acropora cytherea,* patchy necrosis (tissue loss) on *M. patula*, *M. capitata* and *M. incrassata*; ring syndrome was observed on *M. patula* and *M. capitata*, protuberant tumors found on *M. patula,* and abnormal growths were found on *M. patula*. There was very little predation (fish, snail, COT) found on corals, significantly less than in the NWHI.

January 12, 2004
JOH1: NW lagoon patch reef. Depth 15-20 ft. Overall coral cover visually estimated at 70%. Dominant coral species in descending order were *Montipora capitata*, *M. patula*, and *Acropora cytherea.* Coral densities averaged 4.8 colonies per m^2 and only 8 species were reported. Disease assessment along both transects: 1 *Acropora cytherea* with plaque-like signs and one *M. patula* with abnormal growths.

JOH2: lagoon patch reef. Northwest side of Sand Island. Maximum depth 24 ft. Overall coral cover visually estimated at 60%. Coral densities were high, averaging 8.2 colonies per m^2. Ten coral species reported at site. Dominant corals in descending order were *Montipora capitata, M. patula,* and *Acropora cytherea.* Strong currents. Five colonies of *A. cytherea* with plaque-like signs. Two colonies of *M. capitata* with tissue necrosis.

January 13, 2004
JOH3: NE lagoon pinnacle reefs. Maximum depth 34 ft. Overall coral cover visually estimated at 50%. Dominant coral was *M. patula,* with *M. capitata* and *Pavona duerdeni* distant runner-ups. Twelve species reported and coral densities were high, averaging 7.3 colonies per m^2. Ridges of coral separated by sand channels. Disease assessment: mild bleaching in some colonies of *M. patula* and *M. capitata*; 19 colonies of *M. patula* with patchy necrosis; 3 colonies of *M. patula* with ring syndrome, and 2 colonies of *A. cytherea* with plaque-like signs.

JOH4: Shallow ring-shaped patch reef in NW lagoon. Depth 18 ft. Overall coral cover visually estimated at 30% but coral densities the highest at any site, 11.2 colonies per m^2. Ten species reported at site. Dominant coral species were *Montipora capitata* followed by *M. patula.* Lots of sediment, ~1 knot current. Disease assessment: mild bleaching in some colonies of *M. capitat*a. One colony *M. patula* with abnormal growths, one colony with ring syndrome.

JOH5: Edge of dredged channel and pinnacles in N lagoon. Depth 36 ft. East side of North Island. Coral ridges separated by sand channels. Coral cover visually estimated at 60% and 9 species reported at site. Dominant coral species were *M. capitata* followed by

M. patula, and coral densities averaged 6.1 colonies per m^2. Mild bleaching in some colonies of *M. capitata* and *M. patula*. One colony of *A. cytherea* with mild bleaching. Thirteen colonies *M. patula* with purple patch necrosis, 2 colonies with white spot necrosis and two colonies of *A. cytherea* with plaque-like signs.

January 14, 2004
JOH6: Open central deep lagoon, coral mounds, depth 56 ft. Coral cover visually estimated at 40% and coral diversity was the highest of any site, 22 species. Coral densities averaged 3.3 colonies per m^2. Dominant coral species were *Pavona duerdeni*, followed by smaller species of *Acropora* (*A. cerealis*, *A. valida*) and large table coral *A. cytherea*. Ridges of coral surrounded by sand. Lots of sediment. Murky water. No bleaching, no disease. *Acanthaster* predation on *M. patula* and *Drupella* predation on *A. cerealis*.

JOH7: Open central lagoon, coral ridge, depth 37 to 56 ft. high sediment. Dominant coral species were *Pavona duerdeni* with *Montipora patula* a close second. Murky water, with overall coral cover visually estimated at 50%. Coral densities low at 2.7 colonies per m^2 although diversity was high at 16 species. Mild bleaching in a few colonies of *M. patula*, One colony of *M. patula* with an abnormal growth and one colony with tissue necrosis. One colony *M. incrassata* with patchy necrosis.

JOH8: open lagoon, coral ridge, South of East Island. Lots of the green alga *Caulerpa*, and old, dead *Acropora cytherea* tables covered in coralline algae. Lots of sediment, water murky. Maximum depth 28 ft. Overall coral cover visually estimated at 25%, 10 species reported and coral densities averaged 3.2 colonies per m^2. Dominant coral species were *Montipora patula* with *M. capitata* a distant second. A few colonies of *M. patula* with mild bleaching. One *A. cytherea* with plaque-like signs, three colonies *M. patula* with purple patch necrosis, one colony of *M. incrassata* with purple patch necrosis.

January 15, 2004 – no videotape available for transects
JOH9: Shallow central lagoon pinnacles, patch reef and coral ridge, between Sand and East Island. Depth 35 ft. Coral cover visually estimated at 10%, 13 species of coral reported at site, and coral densities averaged 6.7 per m^2. Thick sediment covering everything. *Montipora patula* and *M. capitata* co- dominant species. Lots of *Montipora* with apparent fish predation marks similar to those made by butterflyfish. Mild bleaching in ~1/3 of the *M. capitata* colonies, 5-10 cm size class. One colony *M. capitata* patchy necrosis, 3 colonies *M. patula* patchy necrosis, one colony *M. patula* ring syndrome.

*JOH10***:** Protected N lagoon in “Blue Hole” channel dredged in 1960’s and now consisting of table coral mounds, E of North Island, near 2nd buoy, one of Maragos permanent sites. Depth 52 ft. Dominant corals in descending order were *A. cytherea*, *M. capitata*, and *M. patula*. Coral cover visually estimated at 50% and coral densities averaged 3.5 colonies per m^2. A few colonies of *M. patula* with mild bleaching. Four colonies *M. patula* patch necrosis, one *M. capitata* and 2 *M. patula* with ring syndrome, two colonies *A. cytherea* with plaque-like signs. Many more *A. cytherea* colonies in area with plague.

January 16, 2004
JOH11: Open lagoon patch and pinnacle reefs, S of Johnston Island, depth 52 ft. Dominant coral species *Montipora patula* with *M. capitata* a distant second. Huge mounds of *Montipora* with some sediment covering reef. Good visibility during dive. Coral cover visually estimated at 80%. Thirteen coral species reported at site, and coral densities averaged 3.5 colonies per m^2. One colony *M. patula* mild bleaching, 26 colonies *M. patula* patchy necrosis, 2 *M. patula* ring syndrome, 2 *M. capitata* patchy necrosis.

*JOH12***:** North protected lagoon patch and pinnacle reefs, close to backreef. Depth 49 ft. Mountains of *Montipora* and a giant *Pocillopora eydouxi* colony ~ 5 ft high. Low sediment, clear water during dive. Overall coral cover visually estimated at 80%. Fourteen species reported at site with coral densities averaging 4.2 colonies per m^2. Dominant corals in descending order are *Montipora capitata, M. patula,* and *Acropora cytherea.* Nine colonies *M. patula* ring syndrome, 1 *M. patula* protuberant tumors, 2 *A. cytherea* plaque-like signs.

2. U.S. Phoenix Islands

Howland Island

Surveys were conducted at six sites around the island during January 21-22, 2004. One site (HOW-5 deep) was a deep observation and collection dive where a full REA was not accomplished. Three dives were at permanent monitoring sites (HOW-14P, -5P, -11P), and two were full resurveys of previous non-permanently marked REA sites (HOW-16, -17). Dive depths ranged from 22 to 90 feet. Dr. Maragos (USFWS) conducted coral counts at two REA sites, made an inventory of species and the relative abundance at the one deep site, and took photographs of the quadrats along the three permanent transects. Dr. Greta Aeby (DAR) assessed bleaching and disease at all sites and assisted in the photoquadrat surveys. Results of the permanent transect surveys will be reported later after analysis of photographs; however, all permanent sites were located, fully resurveyed, and fully repaired (replacing loose or lost stakes) during the visit.

*General observations on coral diversity, populations and distribution***.** Corals appeared little changed at the 5 sites previously surveyed in early 2002. A few new records and genera were added to the inventory of species bringing the totals up to 25 genera and 92 species for stony corals and 29 genera and 96 species for all corals and anemones. The wire coral, *Cirrhipathes*, and spiny brain coral, *Symphyllia*, were reported for the first time at Howland at the deep site. Coral densities were moderate, averaging 2.9 corals per m^2 along the REA transects, but many intermediate and large colonies were present. The high temperature episode last year at Howland measured via NOAA satellites apparently has had no apparent effect on established corals. However, the number of small colonies was low at all sites, partly due to the difficulty in detecting them during the wave action at all sites, and perhaps possibly due to other factors such as last year's high temperatures. Staghorn and table forms of *Acropora* were abundant or dominant at all sites.

General observations on bleaching and disease. The corals were in good condition with little evidence of bleaching and very few colonies with any signs of disease. Disease signs were limited to one montiporid colony with a small (~1 cm) tumor and a poritid colony with pink necrotic circular patches. Small patches of denuded skeleton were frequently observed on acroporids and seemed to be associated with damselfish activities (*Plectroglyphididon* sp.). Fish predation on the tips of pocilloporids and branching acroporids was also evident.

January 21, 2004
HOW-14P: NW ocean fringing reef slope, depth 30 ft., coral cover estimated at 60%. No evidence of bleaching or disease. A total of 50 one-meter-square photoquadrats were taken along the line for later analysis and reporting. The dominant coral was *Acropora,* especially staghorn and small tables. *Pocillopora* and *Montipora* were abundant.

HOW-5P: W ocean fringing reef slope, depth 22 ft., coral cover estimated at 70%. No bleaching. Disease was limited to one small tumor found on a montiporid colony. A total of 50 one-meter-square photoquadrats were taken along the line for later analysis and reporting. The dominant corals were *Acropora,* especially staghorn and small tables, and plate-like *Montipora*.

HOW-11P: SW ocean fringing reef slope, depth 30 ft., coral cover estimated at 65%. A few colonies of *Fungia scutaria* showed minor bleaching. No signs of disease. A total of 50 one-meter-square photoquadrats were taken along the line for later analysis and reporting. *Acropora*, *Pocillopora* and *Montipora* were dominant or abundant.

January 22, 2004
HOW-5 (deep): W deep ocean fringing reef slope, depth 90 ft., coral coverage averaged 33%. A total of 39 species of corals reported at the site including the typically deep-dwelling wire coral *Cirrhipathes.* Coral cover was lower at depth due to steep unstable, sediment cover (10%). *Acropora* was the dominant coral except at depths below 60 ft.

HOW-16: NW ocean fringing reef slope, depth 36 ft., coral cover estimated at 60%. Minor bleaching observed in a few colonies of *Favia stelligera*. Disease was limited to one *Porites lobata* colony with pink, circular necrotic patches. Coral densities averaged 2.9 colonies along the two transects. The dominant corals in descending order of abundance were *Pocillopora, Pavona, Acropora,* and *Montipora.*

HOW-17: SW ocean fringing reef slope, depth 35 ft., coral cover estimated at 50%. No evidence of bleaching or disease. Coral densities averaged 2.9 colonies along the two transects. The dominant corals in descending order of abundance were *Montipora, Pocillopora*, *Acropora*, and *Pavona.*

Baker Island

Surveys were conducted at six sites between January 23, 2004 and January 24, 2004. Three sites were permanent monitoring sites (BAK-16P, -5P, -11P) previously established by Dr. Jim Maragos during 2000-2002, and three were non-permanently marked REA sites (BAK-2,-7,-9). Dive depths ranged from 28 to 37 ft. Dr. Maragos, (USFWS) conducted coral counts, inventory of species, and relative abundance estimates of corals at all of the REA sites. Dr. Greta Aeby (DAR) assessed bleaching and disease at all sites. Maragos also took the photographs along the three permanent transects with Aeby providing assistance. Results of the permanent transect surveys will be reported later after analysis of photographs; however, all permanent sites were located, fully resurveyed, and fully repaired (replacing loose or lost stakes) during the visit.

*General observations on coral diversity, populations and distribution***.** Corals appeared little changed at all sites previously surveyed in 2001-2002. Several new records of species and 2 genera were reported during the 2004 surveys, including the stony corals *Astreopora* and *Acanthastrea* and the bubble-tip anemone *Entacmaea.* Another small, unidentified anemone resembling *Aiptasia* was also prolific within the protective bases of the staghorn coral *Acropora* thickets dominating several sites. A total of 30 genera and 80 species of stony corals have now been reported from Baker, and 88 species and 35 genera of all corals and anemones have now been reported. The species numbers are lower and the genera numbers higher than reported at nearby Howland. Corals appear to be little changed from the previous 2002 visit even though high sea-surface temperatures were reported last year at both Howland and Baker. Coral densities are low, ranging from 1.8 to 2.3 corals per m^2 compared to Howland, but average colony size is higher. *Acropora* formed expansive staghorn thickets at half of the sites and dominated the coral fauna at all sites. In contrast to Howland, *Montipora, Pavona,* and *Porites* were not common.

*General observations on bleaching and disease***.** A moderate amount of bleaching was observed in some species of faviids and acroporids. No signs of disease were found.

January 23, 2004
BAK-16P: windward E ocean forereef terrace, depth 35 ft., coral cover estimated at 90%. The staghorn coral *Acropora* monopolized most substrates and discouraged other stony corals. No evidence of bleaching or disease. A total of 50 one-meter square quadrat photos taken at the site to be later reported upon.

BAK-9: SE ocean fringing reef slope, depth 35 ft., coral cover estimated at 80%. Approximately 80% or greater of all *Favia matthaii* and *F. stelligera* colonies were partially bleached. Bleaching was especially pronounced on regions of colonies receiving the greatest amount of sunlight. No evidence of disease. Coral densities averaged 1.8 colonies per m^2 and the dominant corals in descending order were *Acropora* and *Pocillopora.* A total of 27 species reported from the site.

BAK-2: S ocean fringing reef slope, depth 37 ft., coral cover estimated at 40%. Partial bleaching observed in several colonies of *Favia matthaii* and one colony of *Acropora* sp. An area with a dense conglomeration of anemones with anemone fish contained two bleached anemones. Coral densities averaged 1.8 colonies per m^2 and the only dominant coral was *Acropora.* A total of 35 species reported from the site.

January 24, 2004
BAK-7: SW ocean fringing reef, depth 33 ft., coral cover estimated at 80%. Partial bleaching in several colonies of *Favia matthaii*, *F. stelligera* and *Fungia scutaria*. No signs of disease. *Acropora* was the dominant coral, although 40 species of corals and anemones are reported at the site, the most of any at Baker. Coral densities averaged 2.3 colonies per m^2.

BAK-5P: W ocean fringing reef slope, depth 35 ft., coral cover estimated at 60%. No evidence of bleaching or disease. Dominant coral was *Acropora.* A total of 50 one-meter-square quadrat photos taken at the site, to be later analyzed and reported upon.

BAK-11P: NW ocean fringing reef slope, depth 30 ft., coral cover estimated at 70%. Approximately 10% or less of the branching acroporids had partial bleaching. There was one bleached anemone in another dense conglomeration of anemones and anemone fish. No signs of disease. The only dominant coral was *Acropora.* A total of 50 one-meter-square quadrat photos taken at the site, to be later analyzed and reported upon.

Appendix C: **Algal REA Team Activity Summary** *(Peter Vroom and Kim Page)*

A. Methods

Standardized quantitative sampling methods for remote tropical Pacific islands were developed and published for marine algae (Preskitt et al., Pacific Science 2004). To allow for vertical sampling in areas of high relief (walls), the method was modified slightly by Vroom et al. (in review, Coral Reefs) and entails photographing quadrats, collecting algal voucher specimens, creating in situ algal species lists, and ranking relative algal abundance. This modified "Preskitt method" has been used by CRED since 2003 in the Northwestern Hawaiian Islands, Guam/Mariana Islands, Pacific Remote Island Areas, and American Samoa.

B. Results

1. Johnston Atoll

Turf algae were the main space occupiers in the benthic community for the majority of sites examined. Green algae (particularly *Caulerpa*) were the most prevalent fleshy macroalgae found in lagoonal reef environments. Macroalgal cover was very low, as would be expected for a healthy tropical coral reef ecosystem. *Halimeda*, one of the most common algae in the main and Northwestern Hawaiian Islands, was surprisingly scarce in all lagoonal environments sampled (Table C-1).

Site Descriptions:
JOH-1 1/12/04
This site was a patch reef north of Johnston Island near a dredged channel. Depth ranged from 5 to 25 feet with a high current due to the large northwest swell. The site was dominated by *Acropora cytherea* and had white silt channels between coral ridges. There were no visible macroalgae seen; however, there was turf and crustose coralline algae as well as a green slime that may or may not be an alga.

JOH-2 1/12/04
This site was a patch reef north of Sand Island with depths ranging from 14 to 30 feet. Coral dominated this site with *Acropora* spp., the most dominant. Very little macroalgae were found; however, two specimens of *Caulerpa serrulata* were found under a dead *Acropora cytherea* head. These specimens had extraordinarily long rhizomes. *Dictyosphaeria* sp. and *Valonia* sp. were found during the random swim. In the photoquadrats, turf and crustose coralline were the most common as well as a large pinkish pillow like blue-green. There was a swell driven current at this site from the west.

JOH-3 1/13/04
Lagoon reef on the northeast side of the atoll; depths ranged from 20-45 feet. The site was characterized by coral ridges with deeper sand channels. *Halimeda* sp. and *Caulerpa serrulata* were collected during the random swim while turf, crustose and branched coralline, and *Lobophora variagata* were seen in the photoquadrat.

JOH-4 1/13/04
Lagoon reef near Akau Island. Depths ranged from 7 to 20 feet. Reef was a linear reef with sand channels on either side. In the photoquadrats turf algae, crustose coralline as well as one *Ventricaria ventricosa* were seen. During the random swim *Dictyosphaeria versluysii*, *Caulerpa serrulata*, and *Lobophora variegata* were collected.

JOH-5 1/13/04
This site was a lagoonal reef next to Akau Island near mooring buoy with depths ranging from 10 to 50 feet. Very large *Acropora cytherea* (table corals) as well as the green slime that has now been determined as a tunicate dominated this site. *Caulerpa serrulata* and *Ventricaria ventricosa* were collected during the random swim. The photoquadrats contained primarily turf and coralline algae.

JOH-6 1/14/04
This site was a lagoonal reef on the south open facing side of the atoll with depths ranging from 49 to 54 feet. In the photoquads there was primarily turf, crustose coralline, and *Halimeda* sp. During the random swim, *Chrysymenia* sp., *Caulerpa serrulata*, C. *macrophysa*?, and *Dasya* sp. were collected.

JOH-7 1/14/04
This site was a lagoonal reef on the south open facing side of the atoll with depths ranging from 34 to 55 feet. This site had coral ridges with deep sand channels and was characterized by the abundance of what is thought to be *Caulerpa macrophysa*. Vertical walls of this reef were completely carpeted by this alga. In addition to this Caulerpa, turf, crustose coralline, and *Halimeda* sp. were seen in the photoquadrats. During the random swim, *Bryopsis* sp., *Caulerpa cupressoides, C. taxifolia*, and *Haloplegma* species were collected.

JOH-8 1/14/04
This site was a leeward lagoonal reef close to Hikina Island. This site was characterized by ridges of calcified pavement with sand channels between as well as overturned *Acropora* heads. Inside the photoquads there was calcified corallines, turf, *Halimeda* sp., *Caulerpa macrophysa*, *Lobophora variegata*, *Caulerpa cupressoides*, and *Dictyosphaeria versluysii*. During the random swim *Caulerpa serrulata*, *C. taxifolia*, and *Chrysymenia* species were collected.

JOH-9 1/14/04
This reef was a leeward open lagoonal patch reef south of Sand Island with depths ranging from 26 to 36 feet. This site was characterized by crustose coralline algal ridges over dead *Acropora* heads separated by silt sand channels. In the photoquads branched corallines, turf algae, *Caulerpa macrophysa*, *Dasya* sp., *Halimeda* sp., *Chrysymenia* sp., *Caulerpa cupressoides*, and bluegreens were seen along with the crustose corallines. During the random swim *Caulerpa taxifolia* was found.

JOH-10 1/14/04
This site was a lagoonal reef located east of Akau Island under a white mooring buoy. Jim Maragos put in permanent transect pins. We worked at depths between 40 and 50 feet although portions of the reef extended to about 10 feet below the surface. The site

was extremely coral rich and dominated by *Acropora cytherea* and *Montipora* spp. Macroalgae were extremely scarce and much of the open space was occupied by a deep green tunicate that mimicked algae (what we initially referred to as "green slime"). Turf algae and a small *Ventricaria ventricosa* were found in the photoquadrat areas while a small *Caulerpa serrulata* was collected during the random swim.

JOH-11 1/16/04
This site was a lagoonal reef located south of Johnston Island with depths ranging from 30 to 38 feet. This reef was characterized by high rugosity and many recently broken *Acropora cytherea* (table coral) most likely due to high current or swell. In the photoquadrats, turf, crustose coralline algae, *Lobophora variegata*, *Dictyota* sp. and a blue-green algae were seen. During the random swim, *Bryopsis* sp. and *Dasya* species were collected.

JOH-12 1/16/04
This site is a lagoonal patch reef directly north of the navigational channel. This site was very similar to JOH-10 with depths ranging from 25 to 36 feet. The site was coral dominated with very few macroalgae. In the photoquadrats, turf, crustose coralline algae, and *Lobophora variegata* were seen. *Caulerpa serrulata*, *Ventricaria ventricosa*, and a blue-green alga were collected during the random swim.

2. U.S. Phoenix Islands

Even though separated by only 35 miles, the algal floras of Howland and Baker appear distinct. After 3 expeditions to these islands, *Wrangelia* sp. has only been found on Howland Island, while *Halimeda micronesica* has only been found on Baker Island. This may be because of limited sampling or some oceanographic regime that serves as a barrier to algal dispersal between the two islands. Pavements of pink crustose coralline algae dominate many sites at both islands. Macroalgal cover was very low, with most fleshy macroalgae restricted to protected areas between coral fingers (Table C-2).

Site Descriptions

Howland Island
HOW-14P, 5P, 11P, and 16 1/21/04 and 1/22/04
These sites were near island reefs and were all located on a steep reef slope on the west side of Howland Island. The area sampled had a depth ranging 20 to 40 feet with a view of a much deeper drop. The site was dominated by crustose coralline algae and coral. In addition to crustose coralline algae, *Wrangelia* sp., *Halimeda fragilis*, *Lobophora* sp., *Avrainvillea*, *Dictyosphaeria* sp., blue-green algae, and turf algae occurred in the photoquads. During the random swim *Caulerpa serrulata* was collected as well.

Baker Island
BAK-16P 1/23/04
This was a shelf on the east side of Baker Island with a depth of 35 feet. This site was dominated by a monotypic thicket of *Acropora nobilis* with occasional sand patches. Crustose coralline and turf algae grew on the lower branches of coral. *Halimeda fragilis*, *Jania* sp., and *Dictyosphaeria versluysii* were also collected.

BAK-9 1/23/04
This site was on the southeast corner of the island with depths ranging from 15 to 50 feet. Occasional *Acropora nobilis* patches were separated by more diverse stretches of reef slope. In shallower water there were dense mounds of branched coralline algae. In the photoquadrats, turf algae, crustose coralline algae, *Peyssonnelia* sp., *Halimeda fragilis*, *Halimeda micronesica*, *Laurencia* ?, *Lobophora* sp., branched coralline algae, *Dicyosphaeria* sp., and blue greens were present. *Caulerpa serrulata* was collected on the random swim.

BAK-2 1/23/04
This site was located on the south side of the island and was similar to the sites at Howland Island with a more gradual slope. Depths ranged from 25 to 50 feet. This site was characterized by dense patches of *Acropora nobilis* interspersed with more diverse coral patches. In the photoquadrats, *Halimeda micronesica*, *H. fragilis*, *Bryopsis* sp., *Laurencia* ?, *Lobophora* sp., turf algae, crustose coralline algae, branched coralline algae, and blue-green algae were seen. *Caulerpa serrulata*, *Avrainvillea* sp., and *Dictyosphaeria* sp. were collected during the random swim.

BAK-7 1/24/04
This site was located on the southwest side of Baker Island with depths ranging from 31 to 40 feet. We sampled on a slope of *Acropora nobilis* that ended at about 60 feet and became a sand flat. There was a large amount of dead and broken A. nobilis pieces. Among the fingers of *A. nobilis,* turf algae, *Lobophora* sp., *Dictyota* sp., crustose coralline algae, *Bryopsis* sp., *Laurencia* ?, and blue-green algae were found. During the random swim, *Halimeda fragilis* and *Galaxura filamentosa* were collected.

BAK-5P, BAK-11P 1/24/04
These sites were located on the west side of Baker Island. Working depths ranged from 15 to 50 feet with the slope continuing deeper. *Acropora nobilis* patches alternated with more diverse areas including bubble anemone beds characterizing these reefs. In the photoquads, crustose coralline algae, turf algae, blue-greens, *Lobophora* sp., *Dictyota* sp., *Laurencia* ?, *Bryopsis*, *Dictyosphaeria cavernosa*, *Galaxura filmentosa* were found. At site 5P *Halimeda micronesica* was seen during the random swim.

	JOH1	JOH2	JOH3	JOH4	JOH5	JOH6	JOH7	JOH8	JOH9	JOH10	JOH11	JOH12	Island Average
GREEN ALGAE													
Bryopsis							*				*		
Caulerpa			**8.33** *5.00*	*	*	**16.67** *3.5*	**41.67** *1.4*	**25** *3.00*	**58.33** *2.86*	*		*	**12.50** **(19.62)** *3.15* *(1.30)*
Dictyo-sphaeria				*	**8.33** *3.00*	**8.33** *5.00*		**8.33** *5*	**8.33** *6.00*				**2.77** **(4.10)** *4.75* *(1.26)*
Halimeda			*			**41.67** *3.00*	**16.67** *3.5*	**50** *3.33*	**16.67** *2.5*				**10.42** **(17.81)** *3.08* *(0.44)*
Ventricaria				**8.33** *4.00*	**33.33** *2.00*					**8.33** *2.00*		*	**4.17** **(9.73)** *2.67* *(1.15)*
RED ALGAE													
Chrysymenia						*		*	**8.33** *5.00*				**0.69** **(2.41)** *5*
Dasya						*					*		
Haloplegma							*						
branched coralline			**75** *1.67*			**41.67** *2.00*		**8.33** *2.00*	**16.67** *3.00*				**11.81** **(23.42)** *2.17* *(0.58)*
crustose coralline	**25** *2.33*	**66.67** *2.25*	**50** *3.5*	**33.33** *2.25*		**75** *2.22*	**75** *2.44*	**83.33** *1.70*	**75** *1.78*		**66.67** *2.00*	**33.33** *2.00*	**48.61** **(29.69)** *2.25* *(0.50)*
BROWN ALGAE													
Dictyota											**25** 2.67		**2.27** **(7.54)** 2.67 (1.89)
Lobophora			**75** 2.67	*	**8.33** 2.00	**8.33** 4.00	**8.33** 3.00	**8.33** 4.00	**8.33** 3.00		**8.33** 3.00	**16.67** 3.00	**11.81** **(20.56)** 3.08 (0.67)
CYANO-PHYTES	**50** *2.00*	**50** *2.33*	**8.33** *2.00*	**25** *2.33*				**8.33** *2.00*	**16.67** *4.5*			*	**13.19** **(18.96)** *2.53* *(0.98)*

	JOH1	JOH2	JOH3	JOH4	JOH5	JOH6	JOH7	JOH8	JOH9	JOH10	JOH11	JOH12	Island Average
TURF	**91.67** *1.09*	**91.67** *1.09*	**75** *1.56*	**91.67** *1.00*	**100** *1.00*	**91.67** *1.36*	**91.67** *1.36*	**91.67** *1.55*	**91.67** *1.55*	**91.67** *1.00*	**100** *1.00*	**100** *1.00*	**92.36 (6.61)** *1.21 (0.46)*

Table C-1: Algae of Johnston Atoll. Bold numbers indicate the number of photoquadrats in which an alga occurred; italicized numbers indicate the alga's relative abundance (rank) in relation to other algae occurring in the same photoquadrat. Standard deviation of island averages are given in parentheses. Asterisks indicate algae found during the random swim that did not occur in photoquadrats sampled.

	HOW14P	HOW5P	HOW11P	HOW16	Island Average	HOW16P	HOW9	HOW2	HOW7	HOW5P	HOW11P	Island Average
GREEN ALGAE												
Avrainvillea	*		**25** *4.33*	**8.33** *4*	**8.33** **(11.79)** *4.17* *(0.24)*			*				
Bryopsis								**8.33** *4*	**16.67** *3.5*	*	**41.67** *4.2*	**11.11** **(16.39)** *3.9* *(0.36)*
Caulerpa		**8.33** *5*	*	**16.67** *5*	**6.25** **(7.98)** *5* *(0)*		*	*				
Dictyo-sphaeria			**8.33** *5*	*	**2.08** **(4.17)** *5*	**8.33** *3*	**16.67** *5*				**8.33** *4*	**5.56** **(6.80)** *4* *(1)*
Halimeda	**16.67** *2.5*	**16.67** *3*	**50** *3.67*	**50** *3.67*	**33.33** **(19.25)** *3.21* *(0.57)*	*	**66.67** *3.75*	**83.33** *2.6*	**8.33** *3*	*		**26.39** **(38.16)** *3.17* *(0.58)*
RED ALGAE												
Galaxaura									*	*	**25** *4.67*	**4.17** **(10.21)** *4.67*
Jania						**8.33** *3*						**1.39** **(3.40)** *3*
Laurencia							**8.33** *4*	**8.33** *2*	**8.33** *4*	**33.33** *4.75*	**41.67** *3.4*	**16. 67** **(16. 67)** *3.63* *(1.03)*
Peyssonnelia							**16.67** *2.5*	**8.33** *5*				**4.17** **(6.97)** *3.75* *(1.77)*
Wrangelia	**33.33** *3.25*	**25** *3.67*	**66.67** *4*	**25** *4*	**37.5** **(19.84)** *3.73* *(0.36)*							
branched coralline						**8.33** *2*	**25** *3.33*					**5.56** **(10.09)** *2.67* *(0.94)*
crustose coralline	**100** *1.47*	**100** *1.17*	**100** *1.67*	**91.67** *1.91*	**97.92** **(4.17)** *1.54* *(0.32)*	**100** *1.08*	**100** *1.25*	**100** *1.5*	**66.67** *2.75*	**58.33** *2.86*	**66.67** *2.38*	**81.94** **(20.01)** *1.97* *(0.79)*

	HOW14P	HOW5P	HOW11P	HOW16	Island Average	HOW16P	HOW9	HOW2	HOW7	HOW5P	HOW11P	Island Average
BROWN ALGAE												
Dictyota		*						**50** *4*	**83.33** *2.8*	**25** *2.67*	**58.33** *3.14*	**36.11 (33.61)** *3.15 (0.60)*
Lobophora	**41.67** *3.4*	**41.67** *2.2*	**75** *2.56*	**100** *2.33*	**64.58 (28.36)** *2.62 (0.54)*		**58.33** *3.43*	**50** *3*	**91.67** *1.45*	**100** *2.25*	**100** *1.08*	**66.67 (39.09)** *2.24 (0.99)*
CYANO-PHYTES	**16.67** *3.5*		**8.33** *3*		**6.25 (7.98)** *3.25 (0.35)*		**16.67** *2.5*	**8.33** *3*	**16.67** *2.5*	**75** *2.33*	**25** *2.67*	**23.61 (26.57)** *2.6 (0.25)*
TURF	**100** *1.75*	**91.67** *2.18*	**91.67** *1.82*	**91.67** *1.73*	**93.75 (4.17)** *1.87 (0.21)*	**100** *2*	**75** *1.89*	**83.33** *2.4*	**66.67** *1.88*	**91.67** *1.91*	**58.33** *3*	**79.17 (15.59)** *2.18 (0.45)*

Table C-2: Algae of Howland and Baker Islands. Bold numbers indicate the number of photoquadrats in which an alga occurred; italicized numbers indicate the alga's relative abundance (rank) in relation to other algae occurring in the same photoquadrat. Standard deviation of island averages are given in parentheses. Asterisks indicate algae found during the random swim that did not occur in photoquadrats sampled.

Appendix D: **Macroinvertebrate REA Activity Summary** *(Scott Godwin)*

A. Methods

The purpose of the activities for OES-04-01 was to select sites surveyed during previous rapid ecological assessments for long-term monitoring. Selection of sites was based on their year-round accessibility and their representation of the habitats present at each site. Surveys focusing on marine invertebrates other than corals were performed in conjunction with surveys of coral and macroalgae, collectively termed the benthic survey. This benthic survey was conducted collaboratively with fish surveys. This report will cover the non-coral invertebrates encountered and from this point forward any mention of marine invertebrates will mean this particular group.

Quantitative counts for specific target marine invertebrates were done along two separate 2X25 meter belt transects. This was followed by a zigzag pattern that extended 5 meters on either side of the transect line that was done for each of the two lines to record species not within the belt transect. The counts from these two 10X25 quadrats were combined for a 10X50 meter area.

Based on data from previous rapid ecological assessments, a group of target species was chosen for quantitative counts. The species in this list were chosen because they have been shown to be common components of the reef habitats of the central Pacific, and they are species that are generally visible (i.e., non-cryptic) and easily enumerated during the course of a single 50-60 minute SCUBA survey.

These target species were:
CNIDARIA
Zoanthids – rubber corals
Actiniaria - Anemones

ECHINODERMS
Echinoids – sea urchins
Holothuroids – sea cucumbers
Ophiuroids – brittle stars (generally cryptic but are visible in some cases)

MOLLUSCA
Bivalves – ark shells, spondylid oysters, pearl oysters
Nudibranchs – sea slugs
Gastropods – snails
Cephalopods - Octopus
CRUSTACEA
hermit crabs, lobsters, large crabs and shrimp

Collections of species that cannot be identified in the field and samples of coral rubble were brought back to the laboratory on the research vessel. The cryptic organisms found in the rubble are picked out and preserved, and the sand samples are dried and bagged so they can be examined for micro-mollusks at a later date.

The marine invertebrate species recorded and identified during the course of the field operations for OES-04-01 represent the non-cryptic fauna of the reef habitat and should not be considered the only species present at each site. There is an abundance of other organisms, both cryptic and non-cryptic, that dwells in these habitats that are not included in the rapid assessment scheme, which will be included in a final species inventory at a later date.

B. Results

1. Johnston Atoll

Site narratives

JOH-1, Lagoon Reef, Maximum Depth: 17 ft., Location: NNE side of Johnston Island, GPS: 16' 44.394, 169' 32.073

Acropora- and *Montipora*-dominated lagoon reef habitat with high coral cover and broad sand patches. Low macroinvertebrate presence overall, with the exception of vermetid mollusks, which were very abundant. There was a rare occurrence of two echinoderms: the collector urchin *Tripneustes gratilla* and the holothuroid *Holothuria atra*. Also, there was a rare occurrence of the thaidid gastropod *Morula uva* at a depth of 6 feet at the top of the coral structures. A green didemnid tunicate was abundant throughout the site and was noted as growing over some coral colonies.

JOH-2, Lagoon Reef, Maximum Depth: 20 ft., Location: NE, channel area near Sand Island , GPS: 16' 44.979, 169' 30.676

Acropora- and *Montipora*-dominated lagoon reef habitat with high coral cover and broad sand patches. Low macroinvertebrate presence overall, with the exception of vermetid mollusks, which were very abundant and the cephalaspidean sea slug *Chelidonura hirundea*, which was also abundant. There was a rare occurrence of the holothurian *Holothuria edulis*. A green didemnid tunicate was abundant throughout the site and was noted as growing over some coral colonies.

JOH-3, Lagoon Reef, Maximum Depth: 17 ft., Location: NE lagoon, GPS: 16' 46.225, 169' 28.301

Acropora- and *Montipora*-dominated lagoon reef habitat with high coral cover and broad sand channels. High relief moderate abundance of holothuroids. The species *Bohadschia paradoxa*, *Holothuria atra*, and *Actinopyga obesa* were all common in the area. The mollusks *Spondylus* sp. and *Conus distans* were rare and the cephalispidean sea slug *Chelidonura hirundea* was common. A green didemnid tunicate was abundant throughout the site and was noted as growing over some coral colonies.

JOH-4, Lagoon Reef, Maximum Depth: 15 ft., Location: NE Lagoon, GPS: 16' 45.518, 169' 29.728

Acropora- and *Montipora*-dominated lagoon reef habitat with high coral cover and broad sand expanses. This was a linear reef with little macroinvertebrate abundance other than vermetids and the cephalispidean sea slug *Chelidonura hirundea*. The holothuroid *Holothuria hilla* was present as well but was not very abundant. A green didemnid tunicate was abundant throughout the site and was noted as growing over some coral colonies.

JOH-5, Lagoon Reef, Maximum Depth: 40 ft., Location: S side of Akau Island, GPS: 16' 45.607, 169' 30.687

Acropora- and *Montipora*-dominated lagoon reef habitat with high coral cover and broad sand channels. There was a rare occurrence of holothuroid *Actinopyga obesa* and the echinoid *Tripneustes gratilla*. There was an abundance of vermetids and a variety of bivalve shells belonging to two different tellinids, and *Periglypta reticulata*, *Trachycardium orbita* and *Trapezium oblongum*. A green didemnid tunicate was abundant throughout the site and was noted as growing over some coral colonies.

JOH-6, Lagoon Reef, Maximum Depth: 55 ft., Location: S Lagoon, GPS: 16' 41.888, 169' 29.092

Acropora- and *Montipora*-dominated lagoon reef habitat with high coral cover and sand patches. Very high abundance of echinoderms throughout the site. The species in great abundance were *Heterocentrotus mammilatus*, *Echinothrix calamaris*, *Tripneustes gratilla*, *Actinopyga obesa* and *Holothuria whitmaei*. There was a rare occurrence of the hermit crab *Calcinus latens* and the starfish *Acanthaster planci*.

JOH-7, Lagoon Reef, Maximum Depth: 40 ft., Location: S Lagoon, GPS: 16' 42.688, 169' 28.759

Complex reef habitat with high coral cover and sand patches. Low abundance of macroinvertebrates, with the exception of the echinoid *Echinothrix diadema*. The hermit crabs *Calcinus hazletti* and *Dardanus sanguinocarpus* were occasional.

JOH-8, Lagoon Reef, Maximum Depth: 40 ft., Location: S of North Island, GPS: 16' 43.934, 169' 28.978

Acropora- and Montipora-dominated lagoon reef habitat with high coral cover, sand patches and high relief. Low abundance of macroinvertebrates, with the echinoids *Echinothrix diadema* and *Heterocentrotus mammilatus* being rare.

JOH-9, Lagoon Reef, Maximum Depth: 23 ft., Location: S Lagoon, GPS: 16' 43.727, 169' 29.115

Acropora-dominated lagoon reef with moderate coral cover and high relief. Low abundance of macroinvertebrates with rare occurrences of the echinoderms *Holothuria whitmaei*, *Tripneustes gratilla*, and the gastropod *Morula uva*. The hermit crab *Calcinus hazletti* was common at the site.

JOH-10, Lagoon Reef, Maximum Depth: 50 ft., Location: NE of North Island, GPS: 16' 45.815, 169' 30.706

Acropora-dominated reef with high coral cover and drastically high relief and very few sand patches. This was a permanent transect site of Jim Maragos at USFWS, and only a benthic REA was conducted. The macroinvertebrate abundance was low and the only visible species were holothuroid echinoderms. The species present were *Actinopyga obesa*, *Holothuria atra* and *Holothuria edulis*.

JOH-11, Lagoon Reef, Maximum Depth: 35 ft., Location: S side of Johnston Island, GPS: 16' 43.324, 169' 31.436

Montipora-dominated reef with high relief and periodic small sand patches. There was low macroinvertebrate abundance composed of echinoderms and mollusks. The echinoderms were the asteroid *Linckia multifora*, the ophiuroid *Ophiocoma erinaceus*, and the echinoids *Echinothrix diadema* and *Heterocentrotus mammilatus*. A vermetid gastropod was abundant throughout the site and the Thaidid gastropod *Drupa morum* was rare.

JOH-12, Lagoon Reef, Maximum Depth: 41 ft., Location: NE of Johnston Island, GPS: 16' 44.860, 169' 31.441

Acropora- and *Montipora*-dominated reef with a mix of *Pocillopora*. There were broad sand patches with a diverse collection of reef gastropod and bivalve species deposited. These mollusk shells were collected to document these cryptic species. Overall the abundance of macroinvertebrates was low, with the exception of vermetid mollusks. The species present were the holothuroid echinoderms *Actinopyga obesa* and *Holothuria atra* and the echinoid echinoderms *Echinometra mathaei* and *Tripneustes gratilla*. The mollusk species recorded were the bivalves *Arca ventricosa* and *Spondylus violascescens*. A green didemnid tunicate was common throughout the site.

All reef areas surveyed were located within the lagoon habitat. Each site was dominated by coral and was low in macroinvertebrate abundance, with the exception of JOH-6. This particular site was high in abundance and diversity of echinoderms and other marine invertebrates. Mollusks from the family Vermetidae were present in great abundance throughout all sites. A green didemnid tunicate was noted at some sites to be overgrowing some *Acropora* and *Montipora* coral colonies. The majority of lagoon reef sites surveyed had impressive coral cover but were lacking in abundance and diversity of non-cryptic macroinvertebrates. Processing and identification of cryptofauna sampled from dead coral heads and rubble will yield a greater number of species than the non-cryptic fauna noted during surveys.

2. U.S. Phoenix Islands

Site Narratives

Howland Island, January 21-22, 2004

Sea conditions only allowed surveys to be performed on the west side of the island. The habitat in this area was the same at all sites surveyed. Therefore, a single narrative will be written for all sites surveyed (Table D-1).

The habitat was a steep reef slope dominated by *Acropora* and *Montipora* corals. The target species recorded during all surveys were uniform throughout all sites at all depths. There was great abundance of cnidarians, mollusks, crustaceans, and echinoderms but diversity was low. One site, HOW-5P, had the appearance of being disturbed by weather event. This site had damage to Acropora in discrete areas, and abundance of taxa was lower at this site. The southernmost site HOW-17 had the greatest abundance of all taxa, especially giant clams. Narratives for discrete taxonomic groups are as follows:

Cnidarians

The corallimorpharian *Rhodactis howseii* was abundant at all sites. Zoanthids from the genera *Palythoa* and *Zoanthus* were present but in low abundance.

Mollusca

Giant clams (*Tridacna maxima*) and octopuses were common and abundant at all sites, with the exception of the disturbed site HOW-5P. Coralliophilid snails were the most common gastropod seen throughout all sites. There was an unexplained absence of live *Turbo argyrostoma* snails at all sites. Another species that was conspicuously absent was the gastropod *Astralium rhodostoma*.

Echinoderms

The dominant and most abundant echinoderm species at all sites was the urchin *Diadema sauvignyi*. Also present were two starfish species, *Linckia multifora* and *Linckia guildingi*, and the holothuroids *Holothuria atra* and *Actinopyga mauritiana*. The cryptic brittlestar species *Ophiocoma erinaceus* was noted regularly at all sites.

Crustacea

There were a variety of cryptic crustaceans at all sites, including coral guard crabs (Trapezidae) associated with both *Pocillipora* coral heads and certain Acropora coral species. Cryptic shrimp species from the genera *Lysmata*, *Stenopus* and *Saron* were commonly seen. Hermit crabs were also commonly seen at all sites, with the species *Calcinus hazletti* being the most common. The spiny lobster *Panulirus versicolor* was only seen at two of the survey sites HOW-14P and HOW-17.

Overview

With the exception of site HOW-5P on the central portion of the west side, all sites appear to have intact and healthy population of non-coral invertebrates. This site appears to have been disturbed by weather event, and populations of non-coral invertebrates was lower and less diverse. There was a conspicuous absence of the snails Turbo argyrostoma and *Astralium rhodostoma* at all sites, but giant clam populations appear to be healthy. The southwest part of the island had the highest density of giant clams and other taxa of all the sites on the western side.

Baker Island, January 23-24

Favorable sea conditions allowed access to sites from the southeast side to the northwest side. Habitats differed greatly and will be covered in separate narratives.

BAK-16P, Maximum Depth: 35 ft., Habitat: Terrace reef, GPS: 00' 11.698, 176' 27.753

This was a reef on the southeastern terrace that was composed of *Acropora nobilis* exclusively. There were few non-coral invertebrates except for *Diadema sauvignyi* sea urchins, the starfish *Linckia multifora* and an unknown species of bryozoan.

BAK-9, Maximum Depth: 40 ft., Habitat: Forereef slope, GPS: 00' 11.220, 176' 28.193

Reef slope dominated with a mixture of branching and table *Acropora*. An unknown anemone, which had the characteristics of the family Aiptasidae, was very abundant on the branches of coral colonies. The bubble anemone *Entacmaea quadricolor* was noted at a shallow depth (18 ft.). The gastropod *Turbo argyrostoma* was rare, while the *Astralium* *rhodostoma* was abundant. The thaidid snail *Purpura aperta* was common and a single individual of the snail *Bursa* was recorded. A single giant clam was also noted at this site. *Diadema sauvignyi* was present but not very common.

BAK-2, Maximum Depth: 40 ft., Habitat: Forereef slope, GPS: 00' 11.298, 176' 28.793
Forereef slope on the southwest side of the island with variable coral cover composed of branching *Acropora* and rubble. The anemone *Entacmaea quadricolor* was abundant at the site along with the unknown anemone mentioned earlier. *Turbo argyrostoma* was rare but large numbers of empty shells were noted at the site. The gastropod *Astralium rhodostoma* was very abundant at the site. The sea urchin *Diadema sauvignyi* was common at the site.

BAK-7, Maximum Depth: 45 ft., Habitat: Forereef slope, GPS: 00' 11.451, 176' 29.336
Forereef slope on southwest side of island with branching Acropora coral as the dominant habitat. There was very little in the way of non-coral invertebrates other than an unknown anemone species growing within the branches of the *Acropora* coral and the bubble anemone *Entacmaea quadricolor*. *Diadema sauvignyi* was common at the site and another sea urchin, *Echinothrix calamaris* was rare.

BAK-5P, Maximum Depth: 45 ft., Habitat: Forereef slope, GPS: 00' 11.451, 176' 29.176
Substrate was covered with a fine growth of turf algae over most of the site. The coral present was a combination of branching and table Acropora, as well as *Pocillopora*. The bubble anemone *Entacmaea quadricolor* was rare. The Thaidid gastropod *Purpura aperta* was very abundant throughout the site, as were a variety of other gastropods. The hermit crabs *Dardanus megisto*, *Dardanus guttatus* were rare while *Dardanus lagopodes*, *Calcinus hazletti* and *Calcinus minutus* were all common. The starfish *Linckia multifora* was very abundant and *Linckia guildingi* was rare. The sea urchin *Diadema sauvignyi* was common and the species *Echinothrix calamaris* and *Echinothrix diadema* were rare.

BAK-11P, Maximum Depth: 40 ft., Habitat: Forereef slope, GPS: 00' 11.938, 176' 29.084
Same as BAK-5P.

Preliminary non-coral invertebrate species richness data for Howland and Baker was generated solely on the species identified in the field and cursory identification of specimens in the laboratory. Many more species exist within each category and will be identified at a later date. The preliminary data is presented in the Table D-2.

Site	Latitiude	Longitude	Depth	Habitat
HOW-14P	00' 48.895	176' 37.434	41	Forereef
HOW-5P	00' 48.237	176' 37.299	40	Forereef
HOW-11P	00' 47.926	176' 37.223	40	Forereef
HOW-5P	00' 48.237	176' 37.299	90	Forereef
HOW-16	00' 48.645	176' 37.358	40	Forereef
HOW-17	00' 47.926	176' 37.223	40	Forereef

Table D-1: Site coordinates for Howland Island.

TAXA	Preliminary Number
PORIFERA	4
CNIDARIA	4
ANNELIDA	3
BRYOZOA	2
MOLLUSCA	37
CRUSTACEA	14
ECHINODERMATA	11
UROCHORDATA	2
TOTAL	77

Table D-2: Non-coral invertebrate species richness data for Howland and Baker Islands, US Phoenix Islands.

Appendix E: **Towed Diver Habitat/Fish Survey Team Activity Summary** *(Brian Zgliczynski, Molly Timmers, Joe Laughlin, and Jake Asher)*

A. Methods

The fish towboard, outfitted with a forward-looking digital video camera, recorded fish distribution and habitat complexity. The diver on this board recorded fishes larger than 50 cm total length along a 10-m swath. The downward looking benthic towboard, affixed with a high-resolution digital camera with dual strobes, photographed the benthic substrate every 15 seconds. The diver on this board calculated substrate percentage every 5 minutes, recorded habitat type and complexity, and tallied the quantity of macroinvertebrates. Each towboard was equipped with a SBE 39 which recorded temperature and depth every 5 seconds along the tow. A GPS was used to record each tow track to geo-reference the collected data.

Towed-diver surveys were conducted across multiple habitats including the forereef, backreef, lagoon, and insular shelf. During the survey period, a large northwest swell greatly impacted visibility and limited the accessibility of sites around the atoll.

B. Results

1. Johnston Atoll

Twenty seven towed-diver habitat and fish surveys were conducted at Johnston Atoll during 5 days of field operations. A total of 52.83 km of benthic habitat was surveyed.

Fish observations

The gray reef shark, *Carcharhinus amblyrhynchos,* was the most commonly observed fish larger than 50 cm TL with 101 observations made primarily on the north and western forereef. Five large (>200 cm TL) galapagos sharks, *Carcharhinus galapagensis,* were also observed on the northwest forereef. Other notable observations included a single sighting of a 275 cm TL tiger shark, *Galeocerdo cuvier,* as well as three humpback whales, *Megaptera novaeangliae*. A large school of big eye jack, *Caranx sexfaciatus,* was observed in the man-made channel west of Johnston Island with over 200 individuals counted. The blacktongue unicornfish, *Naso hexacanthus,* was the second most commonly observed fish larger than 50 cm TL with 57 individuals encountered.

Benthic observations

We observed the dominant habitats along the forereef slope to consist of continuous reef. Along the back reef and adjacent lagoonal environments, we observed the dominant habitats to be both continuous reef and patch reef. Within the insular shelf along the south side, the dominant habitats were rubble and sand flats. Along the eastern insular shelf, the dominant habitats consisted of spur and groove and continuous reef. The dominant habitats in the southeast insular shelf consisted of rubble flats and pavement. For the 27 towed-diver habitat surveys, ~ 1.16% of the coral habitat appeared pale and ~.23% appeared white. Along the southwest forereef, we witnessed a high abundance of fire coral. Over 150 man-made objects were recorded, which included everything from tires to steel frames and pipes. A total of 157 crown-of-thorns starfish were observed with 66.2% observed along the forereef.

2. U.S. Phoenix Islands

The tow team conducted 9 towed-diver habitat and fish surveys at Howland and 8 at Baker. We surveyed approximately 21.2 km of benthic habitat at Howland and 17.13 km at Baker.

Fish Observations

The twin spot snapper (*Lutjanus bohar*), was the most commonly observed fish larger than 50 cm TL with 870 observations made during the survey period. Jacks followed closely behind with 858 observations, 535 of those being the bigeye jack (*Caranx sexfaciatus*). Surgeonfishes were also commonly sighted with 519 observations primarily of the big nose unicornfish (*Naso vlamingii*) and the blacktongue unicornfish (*Naso hexacanthus*). The gray reef shark (*Carcharhinus amblyrhyncos*) was the most commonly observed shark at both Howland and Baker with 363 sightings. A large aggregation of white tip reef sharks (*Triaenodon obesus*) was observed on the west reef of Baker Island making up 38 of the 56 total white tip observations for this survey period. Other notable observations included sightings of the Napoleon wrasse (*Cheilinus undulatus*) and large aggregations of the black snapper (*Macolor niger*) at both islands.

Benthic observations

Howland

For all 9 towed-diver surveys, we observed continuous reef to be the dominant habitat around the entire island. Overall, we recorded 37.5% of the continuous reef to be live coral, 20.5% to be calcareous coral pavement, and 17.37% to be calcareous coral rubble. Along the eastern shore, we observed 47.7% of the continuous reef to be live coral. A total of 360 giant clams were recorded with 58.9% observed along the western shore. No crown-of-thorns starfish were observed.

Baker

We observed the dominant habitat around Baker to be continuous reef, with the exception along the far eastern terrace which was dominated by rubble flats. Overall, we observed 40.9% of the continuous reef to be live coral, 13.8% to be calcareous coral pavement, and 28.9% to be calcareous coral rubble. We observed 57.8% of the continuous reef along the near eastern terrace and the north shore to be live coral. For the 8 towed-diver habitat surveys, ~ 0.13% of the coral habitat appeared pale. Along the western shore, we witnessed an abundance of anchor chains that draped down the reef slope. A total of 17 giant clams were recorded, 14 of which were found along the eastern terrace. No crown-of-thorns starfish were observed.

Appendix F: **Mooring and Drifter Deployments and Oceanographic Data Collection** *(Jamie Gove, Kyle Hogrefe, Christy Kistner, and Jeremey Jones)*

A. Results

1. Johnston Atoll

Johnston Atoll is a new study location for the Coral Reef Ecosystem Division (CRED) and is in general a new study site for a large scale multidisciplinary research cruise such as this one. Since a comprehensive oceanographic study has yet to be performed at Johnston. The oceanographic measurements and deployment of instrument platforms will be an initial assessment of the circulation patterns and overall oceanographic structure in and around Johnston Atoll.

Oceanographic assessments at Johnston Atoll are accomplished by:

1. Continuous recording of surface and subsurface water temperatures as a function of depth during all towed diver operations, providing a broad and diverse spatial temperature sampling method.

2. Shallow Water CTDs (max 30 m), including turbidity measurements at regular spaced intervals around Johnston, sample vertical profiles of water properties, providing indications for water masses and local sea water chemistry changes.

3. Deep Water CTDs (max 500 m) and Acoustic Doppler Current Profiler (ADCP) transects circumnavigating the atoll, which provides information on overall oceanographic structure, including chlorophyll and dissolved oxygen, and circulation patters surrounding Johnston.

Long-term oceanographic monitoring is accomplished by deployment and retrieval of a variety of internally recording and near real-time telemetered instrument platforms. These instruments include:

1. Wave and Tide Recorders (WTRs) which measure spectral wave energy, high precision tidal elevation, and subsurface water temperature.

2. Sea Surface Temperature (SST) Buoys: Surface buoys which measure high resolution water temperature which telemeter data in near-real time.

3. Ocean Data Platforms (ODPs) which measure subsurface temperature and salinity, current profiles, directional spectral wave energy, and high precision tides.

4. Subsurface Temperature Recorders (STRs) which measure high resolution subsurface temperatures.

5. Satellite Drifters, Lagrangian devices which provide surface layer circulation information and water temperatures which telemeter data in near real-time.

Oceanographic measurements and instrument deployments at Johnston Atoll were performed as follows:

Thirty-four shallow water CTDs were performed on the parameter and interior of Johnston. A WTR was deployed on the southwest corner of the atoll, and four STRs and one SST were deployed in the lagoon to the west and north of Johnston Island. Eight deepwater CTDs were taken on the NE, SE, SW, NW corners along with ADCP measurements circumnavigating the atoll. A satellite drifter was deployed off the southwest tip of Johnston in 800 meters of water upon our departure to Howland and Baker.

One SVP drifter (argos 44768) was deployed on January 16, 2004 SW of Johnston Atoll.

2. U.S. Phoenix Islands

Howland and Baker Islands present a highly unique and extremely interesting research location from an oceanographic standpoint. These two islands are geographically located directly in the path of the subsurface eastward flowing Equatorial Undercurrent (EUC). Compared to equatorial surface waters, the EUC is a relatively cold, nutrient rich current. On past research surveys to Howland and Baker, colder temperatures of 1-2 degrees Celsius have been measured on the western side compared to those in surrounding waters. This injection of cold, nutrient rich water stemming from the EUC impinging on the slope of these islands could possibly have ecological impacts on the local coral reef ecosystem.

Oceanographic assessments at Howland and Baker Islands are accomplished by:

1. Continuous recording of surface and subsurface water temperatures as a function of depth during all towed diver operations providing a broad and diverse spatial temperature sampling method.

2. Shallow Water CTDs (max 35 m), including turbidity measurements at regular spaced intervals around each island, sample vertical profiles of water properties providing indications for water masses and local seawater chemistry changes.

3. Deep Water CTDs (max 500 m) and Acoustic Doppler Current Profiler (ADCP) transects circumnavigating each island, which provides information on overall oceanographic structure, including chlorophyll and dissolved oxygen, and circulation patters surrounding Howland and Baker.

Long-term oceanographic monitoring is accomplished by deployment and retrieval of a variety of internally recording and near real-time telemetered instrument platforms. These instruments include:

1. Wave and Tide Recorders (WTRs) which measure spectral wave energy, high precision tidal elevation, and subsurface water temperature.

2. Sea Surface Temperature (SST) Buoys: Surface buoys which measure high resolution water temperature which telemeter data in near-real time.

3. Ocean Data Platforms (ODPs) which measure subsurface temperature and salinity, current profiles, directional spectral wave energy, and high precision tides.

4. Subsurface Temperature Recorders (STRs) which measure high resolution subsurface temperature.

5. Satellite Drifters, Lagrangian devices which provide surface layer circulation information and water temperature which telemeter data in near real-time.

Oceanographic measurements and instrument deployments at Howland were performed as follows:

Twenty-three shallow water CTDs were performed on the perimeter of Howland following a 30-m contour. One SST was deployed off the southeast corner, and 4 STRs were deployed on the north, west, and east sides of Howland Island. Three deepwater CTDs were taken on the north, south, and west sides along with ADCP measurements circumnavigating the island. The SST that was deployed in 2002 was no longer at its original location, but was found and recovered from the beach on the northeast corner.

Oceanographic measurements and instrument deployments at Baker were performed as follows:

Thirty-five shallow water CTDs were taken following a 30-m contour around Baker Island. An ODP was recovered and replaced with a new ODP containing enough battery life for a 2-year deployment. Four STRs were deployed on the west, north, and south ends of Baker. Eight deep water CTDs were taken on the north, northeast, east, southeast, south, southwest, west, and northwest sides of the island. ADCP transects were also performed around the perimeter of Baker Island.

Appendix G: **Night Operations Activities Summary** *(John Rooney, Phil White, Jeremey Jones, and Christy Kistner)*

A. Results

1. Johnston Atoll

Night operations conducted during the period January 11-17 on cruise OES0401 have included: TOAD deployments, QTC data collection, ADCP transects, and CTD casts. TOAD deployments have generally been conducted between 1830 and midnight to minimize overhead costs for required shipboard personnel. These night operations were followed by ADCP transects and CTD casts. On two nights, ADCP transects were run in a box pattern around Johnston Atoll and a CTD cast to 500 m was done at each corner of the box. On two nights, additional CTD casts were done at both the northeastern and southeastern corners of the ADCP box, with additional ADCP lines running in both directions between them. Table G-1 summarizes night operations data collected to date on cruise OES0307.

Following the last cruise in which it was used, OES0308, the TOAD camera sled was modified to make it less likely to snag on the seafloor and more likely to survive such an event; however, the effectiveness of those modifications have not yet been tested. The laser scaling system was also refurbished and that improved the visibility and therefore the usefulness of that feature. The TOAD was also modified to allow the laser system to be mounted up forward to provide a distance scale for video imagery.

Problems with heading data were encountered during the first ADCP series around the atoll. Post-processing may have been able to recover the data but since the time was available, the lines were rerun. We were plagued with repeated failures of the video floodlights on the TOAD. Eventually the problem was traced to the cable supplying AC power to the lights. The existing cable was replaced with an old one and functioned for several tows. The ET onboard, John Skinner, made a new cable from spare parts we had on hand; however, that cable also failed after several deployments. He fabricated another one which was tested on deck, and we are optimistic that it will work in the foreseeable future. However, personnel at the NOAA Fisheries Kewalo Laboratory were e-mailed a request to order a new cable ASAP.

At a safety meeting prior to the first TOAD deployment, Lead Fisherman John Saunders pointed out that on other vessels, camera sleds were run on a slip ring-equipped winch and controlled by the scientist at the video monitor. This setup allows for faster reactions in the event that an obstruction is observed on the seafloor. More importantly, it does not require the winch operator and especially the line tender that we currently use, keeping them out of harm’s way in the event that the ship is moving quickly and the TOAD gets severely hung up on the seafloor. Although an appropriate winch is not currently available on the *Oscar Elton Sette*, including such a winch with the TOAD package should probably be part of the long-term benthic habitat mapping capability.

2. U.S. Phoenix Islands

Night operations conducted during the period January 11-24 on cruise OES0401 have included Towed Optical Assessment Device (TOAD) deployments, QTC (benthic acoustic signature) data collection, acoustic doppler current profiler (ADCP) transects, and conductivity, temperature and depth (CTD) casts. TOAD deployments have generally been conducted between 1830 and midnight to minimize interfering with small boat-dependent daytime operations and overhead costs for required shipboard personnel after midnight. These have been followed by ADCP transects and CTD casts. CTD casts to 500 m were done at each corner of a box around the island or atoll, with ADCP tracks between them. Table G-2 summarizes night operations data collected on cruise OES0401.

It was previously reported that ADCP transects were run in a box pattern around Johnston Atoll on two separate evenings. Problems with heading data were encountered during the first ADCP series around the atoll. The CRED data manager will furnish the *Oscar Elton Sette* with files from the ship's computer system (SCS) that cover the period when ADCP data were collected, so post-processing will be able to recover the data. That is fortunate since the previously reported second ADCP track around Johnston Atoll was never complete. Halfway around it was aborted when the ship encountered large waves.

A frozen bearing on the idler sprocket on the CTD winch precluded conducting the fourth CTD at Howland Island. The Engineering Department was able to fix the problem however, prior to the ship's arrival at Baker Island.

On both Howland and Baker Islands we observed deeper habitats, in the approximate depth range of 80 to 100 m, with complex vertical structure and surprisingly large concentrations of reef fish, sharks, rays, etc. that were more similar to what we would expect during daylight hours. Of particular interest, several Tinker's butterfly fish, *Chaetodon tinkeri,* were observed over multiple tows. This species has never been recorded at these islands before, and these sightings represent a significant increase in the geographic range of these fish, previously reported only in the Hawaiian, Marshall, and Cook Islands.

TOAD deployments at all these locations was challenging due to the steep bathymetry surrounding them. It was difficult, particularly during nighttime hours, to safely operate the ship in water shallow enough for the TOAD to reach the bottom without being too close to shallow reef areas. The captain and crew are well experienced with this operation, however, and with their support we were able to collect more data than we originally thought possible. During the second to last scheduled TOAD deployment of the cruise we were drifting along the southeastern side of Baker Island when a projection of rock caught the TOAD. In previous situations the TOAD cable proved to be remarkably tough. Perhaps previous encounters had weakened the cable or the ship's speed over ground of approximately 1.5 knots was just too much. In any case, the rock was sighted, and we began bringing the TOAD up. The Officer of the Deck responded immediately when the TOAD hung up on the rock, but within 6 seconds of the initial sighting of the rock the cable parted. The location and depth for the TOAD (58.5 m, 192 ft.) were established from data it generated just prior to being lost and from the SCS.

A dive plan was put together and the following morning we called the Unit Dive Supervisor but were unable to do more than leave a message for him. We were able to contact the NLDO, Frank Parrish. Frank was very supportive of our efforts and gave us permission to deploy pairs of divers for no-decompression dives at depths not to exceed 130 ft. to search for the TOAD. Although three separate dives were made, the TOAD was not located. Search efforts were hampered by a strong current and it is not clear that divers at 130 ft. or shallower would be able to distinguish the TOAD on the bottom anyway.

A couple of lessons can be learned from this experience. First, future camera sleds should probably be outfitted with an ultrasonic beacon so finding them can be facilitated using a pinger locator. Secondly, the search conducted for the missing TOAD was severely hampered by the 130-ft. depth and no decompression restrictions. A handful of scientists onboard have significant experience with decompression diving and at least two have closed circuit mixed gas rebreathers that would have been onboard if their use was possible under NOAA Dive Program regulations. An operational hyperbaric chamber and trained operators were also available. In short, most of the pieces were basically in place to safely and effectively conduct decompression dives below 130 ft. to both collect data and respond to situations like this one. The use of advanced diving techniques and equipment in the present case would have greatly boosted the chances of successfully finding and recovering the lost TOAD. The NOAA Diving Program has an opportunity to re-establish the position of leadership it once had in underwater research by embracing recent improvements in both diving technology and methods and facilitating their use by scientists and technicians in the field.

The following paragraph was mentioned in the night operations section of the previous progress report for OES0401, and given the recent loss of the TOAD, is worth repeating. At a safety meeting prior to the first TOAD deployment, Lead Fisherman John Saunders pointed out that on other vessels, camera sleds were run on a slip ring-equipped winch and controlled by the scientist at the video monitor. This setup allows for faster reactions in the event that an obstruction is observed on the seafloor. More importantly, it does not require the dedicated winch operator and line tender that we currently use, keeping them out of harm's way in the event that the ship is moving quickly and the TOAD gets severely hung up on the seafloor. Although an appropriate winch is not currently available on the *Oscar Elton Sette*, including such a winch with future camera sled packages should probably be part of the long-term benthic habitat mapping capability.

At both Howland and Baker Islands we noted significant discrepancies between true and charted positions. Also, particularly on Baker, discrepancies between charted and actual locations of reported depths and reporting of shallow hazards to navigation were not always consistent.

It is also worth noting that for optical validation of benthic habitat maps, the use of small vessels is better suited for the sites visited on this cruise and many other Pacific Islands. Given the unreliability of charts for many of them, in addition to the steep bathymetry, it is unsafe to attempt to collect all the data necessary using a vessel anywhere near as large as the *Oscar Elton Sette*.

Location	No. TOAD deployments	No. Still Photos	No. Video segments	QTC Files	km of ADCP	CTD casts
Johnston Atoll	9	0	9	21	239	239

Table G-1: Night operations conducted around Johnston Atoll.

Location	No. TOAD deployments	No. Still Photos	No. Video segments	QTC Files	km of ADCP	CTD casts
Johnston Atoll	9	0	9	21	239	8
Howland Island	4	0	4	3	73	3
Baker Island	8	0	8	4	125	8
Total	21	0	21	28	437	19

Table G-2: Night operations conducted around the US Phoenix Islands.

Appendix H: **Terrestrial Team Activities Summary (***Beth Flint and Chris Eggleston)*

A. Results

1. Johnston Atoll

The terrestrial team consisting of Elizabeth Flint and Chris Eggleston conducted pelagic bird and mammal transects 6 hours per day during the 3-day transit to Johnston Atoll (9-11 Jan 2004). They recorded all birds and mammals sighted as well as an index of flying fish density along the cruise track. Bird density and diversity was generally low during the transit to Johnston Atoll peaking on the last day (11.5 birds/hour and five different species). The index of flying fish density increased as the ship moved south from 0.6 flying fish per hour on 9 January to 15.8 flying fish per hour on 11 January. One notable bird was a Laysan Albatross sighted at ~18º N, which is a little south of that species' normal pelagic activity area. Upon arrival at Johnston Atoll, Flint and Eggleston took the 14-ft. Avon to shore and remained there assisting the resident FWS staff member until 15 January 2004. They conducted Mean Incubation Counts of Red-footed Boobies, Brown Boobies, Masked Boobies, Great Frigatebirds, and Red-tailed Tropicbirds at North (Akau) Island, Sand Island, and East (Hikina) Island. They also recorded breeding chronology for these and other species nesting at the atoll. Eight of the 15 species of seabirds that typically breed at Johnston Atoll were attending to their eggs or chicks during our visit. A group of at least 3 humpback whales (*Megaptera novaeangliae*) stayed in the vicinity of the *Oscar Elton Sette* for much of the day on 16 January. Wildlife entrapment hazards were identified and mitigated at North Island and FWS staff helped train the contract biologist working for the company presiding over the demolition activities in standard tropical seabird monitoring techniques. They identified monitoring sites to be used on Johnston Island on future visits if the Refuge becomes an unmanned station. Damage to seawalls and landfills from a combination of large swells and high tide that occurred the night of 14 January was recorded and photographed at Johnston Island.

2. U.S. Phoenix Islands

The terrestrial team consisting of Elizabeth Flint and Chris Eggleston conducted pelagic bird and mammal transects 6 hours per day during the 4-day transit from Johnston Atoll (17-20 Jan 2004). They recorded all birds and mammals sighted as well as an index of flying fish density along the cruise track. Bird density was generally comparable to the previous transit from Honolulu to Johnston Atoll peaking on 19 January (15.8 birds/hour), but diversity was higher (8 different species on 19 January). The index of flying fish density was highest on 17 January at 117.3 flying fish per hour. Data from the pelagic observations will be evaluated with respect to the Sea Surface Temperature and Salinity data being collected by the ship's instruments to look for discontinuities or particular signatures that may be associated with high hourly densities of birds or flying fish.

Coxswain Saunders drove Flint and Eggleston to the west landing at Howland Island where they landed at approximately 0930 on 22 January. They commenced a standard rapid ecological assessment of the island by counting and staging all active nests of breeding seabirds, counting wintering shorebirds, listing all plant species and recording their phenological condition as well as looking for other biological phenomena and signs of trespass or introductions of non-native invasives. They recorded GPS waypoints at monuments, landmarks, and other features of biological interest. They also used the GPS to delineate the boundary of the large Sooty Tern colony on the island. They also recorded the condition of all historical and cultural features they were able to visit on this trip and looked for signs of trespass. There were at least 9 species of seabirds breeding at Howland during our visit, and 4 species of wintering shorebirds were noted. Ten species of plants were identified, all but one indigenous to the area. Groups of Bottlenose Dolphins (*Tursiops truncatus*) were seen by divers and by the terrestrial team from shore. No signs of trespass, other vessels, or alien invasive species were discovered at Howland. Jamie Gove and Kyle Hogrefe came ashore at Howland to retrieve the SST buoy and its line discovered by Flint and Eggleston on the northern shore. The FWS shore party was able to spend 24 hours on land, and it rained for much of that time.

Unfortunately the sea conditions at Baker precluded a landing attempt on both days of the ship's visit there. From the ship we observed that the island was as green as Howland had been. No large shrubs were seen at the beach margin however. Bird activity at Baker was higher than that at Howland with huge aggregations of Sooty Terns flying over all parts of the island and large kettles of Lesser Frigate Birds forming in the vicinity of the island. Yellowfin tuna were foraging in the nearshore waters and birds feeding actively over them. No large debris was observed from the ship on any of Baker's beaches. A group of 21 *Tursiops*, including at least two calves accompanied the vessel part of the time during our stay at Baker.